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QUARTERLY

OF THE

National Fire Protection Association

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National Fire Protection Association.

Executive Office, 87 Milk Street, Boston, Mass.

Franklin H. Wentworth, Secretary

October, 1917

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Western Factory Insurance Association.
Western Improved Risk Association.
Western Insurance Bureau.
Western Sprinklered Risk Association.
West Virginia Inspection Bureau.
Wisconsin Inspection Bureau.
Wisconsin State Fire Prevention Association.

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Reports on fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

A TYPICAL GARAGE FIRE.

An employee started a motor inside the building; back-fire occurred; a gasoline tank caught fire, and in a few seconds the flames ignited the wooden ceiling and swept over the entire garage. There were no sprinklers and no skylights.

The Quarterly

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Fire Hazards of the Cantonments. Considerable concern has been expressed over the fire hazards of the cantonments the Government has built in various parts of the country for housing the new National Army. In some of the photographs the wooden buildings are shown rather close together, suggesting the possibility of a destructive, sweeping fire. Some thought has, however, been given to this matter, and where the site permits there is a separating space, or "fire-break," which will give fire-fighters a chance to confine a fire to the building in which it may originate. As the wooden shingle has not been used for roofs, any fire will spread, if at all, to contiguous buildings only, and such fires can undoubtedly be handled successfully by the ample hose lines and water supplies that have been provided. Fires will undoubtedly occur; the almost universal soldier habit of cigarette smoking will provide them; but when the buildings are all occupied, prompt discovery should bring prompt extinguishment.

* * * * *

Apartments and Fires. The building of apartment houses has proceeded with increased rapidity during the past few years under the spur of domestic service problems, and the economic advantages of centralized heating, lighting and other similar items. Modern notions have provided the buildings with new conveniences, and the advantages of apartment life are gaining wider recognition than ever. This winter will find more city dwellers than ever before residing in buildings also occupied by other families and more or less dependent upon the carefulness of others for safety from the fire peril. In a month or two cold weather will necessitate the kindling of fires to heat these and other buildings, and the fire hazard will enter upon its busy season. The interdependence of the flat dwellers, composing so large and so swiftly growing an element of the city populations, should be evidence enough that guarding against fire is not merely a duty of the individual, but a community obligation demanding every individual's full share.*

* See Fires No. H-12045, p. 220, and H-12390, p. 223.

More Feminine Helpfulness! In the January *Quarterly* (Vol. 10, No. 3, p. 240) we reprinted from the *Woman's Home Companion* some advice by Mae Belle Savell to the lady readers of that publication unconsciously calculated to assist them in destroying their homes by fire. But now comes Addie Farrar in the September issue of *The Modern Priscilla* with advice of so certain a touch of confidence in matters beyond her ken as to make Miss Savell's transgressions of the essence of mildness indeed. At the beginning of this illuminating article, which is entitled "Saving Dollars on Household Repairs," Miss Farrar enunciates the admitted truth that plumbers, gas-fitters and electricians charge for the "knowing how" more than for their labor, and declares that repair bills amounting to quite a few dollars annually may as well be saved. Miss Farrar then proceeds to particularize. This is her paragraph on gas:

> **When the Gas Light is Dim.**
>
> When the gas-burner gives a very weak light, try unscrewing the burner and cleaning it out. If this does not help, it means the trouble is higher up in the pipes. Remove the burner again and rap sharply on the long curved pipe that leads to the ceiling. This will remove any of the rust particles that lodge in the pipe and increase the flow of gas. If the pipes spring a leak try and find it and with a home-made preparation of boiled linseed oil and white lead mixed to the consistency of a cement apply to the crack. When this has hardened, test it by holding a lighted match near the leak to be sure that no gas is escaping. A temporary filling may be made by filling the crack with a paste of ordinary laundry soap or any kind of gum. A leak in the gas jet is either in some joint in the fixture or about the jet. It is best to turn off the gas before you work, but if you cannot do this, have a helper who, when you unscrew the fixture at the leaking point, will hold a finger over the end of the pipe. With red lead (a can can be had for ten cents that will last for years), daub the threads where the section screws on and put the fixture back in place and the leak will be gone.

Having disposed of any gas leaks in this masterly fashion, Miss Farrar turns her attention to the electrical equipment. What she says on this subject is thought-arresting:

> **Be Your Own Electrician.**
>
> If you want to remove an electric-light fixture, turn off the switch near the meter, the one that controls the current throughout the entire house, or you may have an accident. When this is thrown, you may work without danger. Unscrew the fixture and find the wires heavily bound with tape and rubber and unwind and separate these two wires. Then re-bind the wires, separately, with bicycle tape, taking care that the naked wires do not come in contact at any point. You may now either paper over the old fixture place or put in a new fixture or attach a socket for a table or standing lamp. If you have many standing lamps in the house, it is well to get a double socket and set and have long wires running from them to the part of the room you wish to light. I sometimes run my wires along the base-board and sometimes along the picture-molding, and in this way I can run them clear around the room and they do not show until they drop to where the light is placed.

The ingenuity with which Miss Farrar puts the ladies up to beating the plumber by cleaning their own bath drains, curing leaky faucets, and so on, is equally diverting, but not so hair-raising to the fire prevention

fraternity, as no result may be expected from the adoption of her advice on these topics except possibly a drenching of the house walls or ceilings. *The Modern Priscilla* is doing a great work for the ladies in circulating such helpful hints on subjects that engineers insist on making such monstrous mysteries!

* * * * *

Clean-up and Paint-up. According to the *Oil, Paint and Drug Reporter,* the "Clean-up and Paint-up" movement, inaugurated to stimulate the paint industry when it was in need of a tonic, has been captured and its benefits to the industry impaired by the indorsement of local boards of health, street-cleaning departments and civic reform associations, whose seizure of the movement as an aid to municipal cleanliness have reduced the benefits to the paint men to merely an incident in the general scheme. The *Reporter* says:

> No better evidence is needed of this change than the insistence during the season of 1917 upon "Thrift Gardens," into which no paint enters—for beanpoles are allowed to weather—and health week work among the negroes of the South with the full co-operation and encouragement of such educational institutions as Tuskegee Institute. The *Reporter* does not belittle the beneficial effects of such movements in the community, but in the emphasis placed upon such philanthropic and neighborhood work there is no doubt that the original intention of the founders of the "Clean-up and Paint-up" plan has been lost—and naturally.

The *Reporter* emphasizes the more fruitful plan of the "Use More Paint" campaign for all-the-year business-building, pointing out the fact that the former was designed—and has shown itself to be—a temporary incentive to business in separated localities, and, even if nationally adopted, would be but a one-week incentive.

* * * * *

Paint-Remover Hazards. Fire Prevention Commissioner O'Keefe, of the Metropolitan District, Boston, recently requested of the fire chiefs in his district notes on fires occurring in their jurisdictions due to the use of paint-removers, which is designed to replace the method of burning off old paint with a torch. Commenting on the results of his inquiries, the Commissioner says:

> I found a concensus of opinion that the blow torch is the more dangerous. I am told, however, that the blow torch has been almost entirely superseded by the paint remover. From six cities and towns I received word of fires caused by paint removers. In all cases those fires occurred during the year 1915 or 1916. All but one occurred in 1916. That would indicate either an increase in the hazard or an increase in the number of fires due to the more general use of the paint remover. The six cities and towns from which I received word of fires caused by paint removers are Boston, Lexington, Revere, Waltham, Quincy and Somerville.
>
> There is a general feeling among the fire chiefs that the paint remover is very dangerous if used in a closed room, or near a flame. I am told that the can carries with it a caution not to use it under these conditions. I have no doubt these fires were due to the negligence of the painter, but, of course, that is a factor that must be taken into account in judging of the hazard of the article itself. The two fires in Boston were said to have been

caused by a spark struck by contact of the scraper with a nail in the floor. They occurred on the same street and within a very few weeks of each other. The fire in Lexington is said to have been due "entirely to carelessness on the part of the man using the remover." The fire in Revere and the fire in Waltham were caused by smoking. The Quincy fire occurred in the open air in a boat yard. The first Somerville fire was started, the chief says, "by the explosion of the remover," and the second Somerville fire was caused by a man "using the paint remover in bath room; the remover leaked through the floor and was ignited by lighted gas jet in the cellar."

It seems to me that the lessons to be drawn from these instances are:

1. That workmen should most rigorously be enjoined not to smoke.

2. That the paint remover should not be used in a closed room, nor near a flame of any kind.

3. That the quantity of it should not be so great that it would escape from the surface to which it is applied.

4. That journeymen should be cautioned of the possible danger involved in striking nails with the scraper.

The lists of inspected devices and materials issued by Underwriters' Laboratories seem to show no paint removers submitted for examination and report by that body. The volatiles such preparations undoubtedly contain should warrant a general knowledge of their character and extreme care in their use.

* * * * *

Fire Protection and Political Boundaries. The irrelevance of political boundaries in the presence of human need is well illustrated by two fires which occurred this summer. We append extracts from the brief reports which appeared in the *Journal of Commerce:*

WHITE SALMON, Wash., June 30.—Fire of unknown origin starting in market of White Salmon Dressed Meat Company destroyed seven business houses, causing a loss estimated at $15,000. The Hood River, Ore., fire department was ferried across the Columbia River, and helped the local volunteers extinguish the flames.

JUAREZ, Mex., July 5.—An American fire company crossed into Mexico last night and put out a fire which was beyond control. As Juarez has no organized fire department, the Mayor appealed to El Paso for help. An automobile hose company responded, being the first fire company to cross the border to Juarez in three years. The loss was estimated at $100,000 gold.

"Intervention" of this sort is rarely resented, and it is probably the best of all antidotes to the hard feelings that are sometimes induced by other kinds of intervention that are more liable to misinterpretation.

* * * * *

Safety to Life. Among other encouraging signs of aroused public interest in the problem of life safety in factory buildings we note the passage of Assemblyman Bewley's bill amending the Labor Law of New York State. According to the *Journal of Commerce,* the bill provides that no point in an unsprinklered building shall be more than 100 feet, and no point in a sprinklered building more than 150 feet, from an exit. The State In-

dustrial Commission is given discretionary power as to the necessity for an additional exit for each 5,000 square feet when the floor space exceeds 5,000 square feet. Only buildings erected subsequently to the passing of the bill, are, however, affected by its provisions.

* * * * *

The Forest Fire.

The mere wastage of timber, amounting to millions upon millions of feet each year, through forest fires is a serious matter enough, but the damage by no means ends there. At one period during the present year the Federal Forest Service was reported to be spending no less than $10,000 a day in fighting fires in Montana alone. From time to time the public mind is shocked by some great forest fire horror, like the Claybelt fires in the summer of 1916, but probably the general view is that a forest fire is principally a question of lumber. A rapid survey of a considerable collection of press clippings reporting forest fires during the present year shows that while the energy and heroism of the fire-fighters again and again avert impending disaster, the hazards attendant upon the forest fire are such as to appeal to every humanitarian. Disregarding the effects of fire upon the fertility of the soil (which is often quite serious) and the burning of the homes of farmers and ranchers, we find school houses destroyed, summer resorts wiped out, a sanitarium endangered, a light and power plant burned out, and no less than fifty sugar mills reduced to ruins. One large fire in California was responsible for three deaths, and rendered sixty families homeless. A town of 1,000 in Idaho was reported completely destroyed. 1,000 sheep were cut off and burned to death in Montana. The largest herd of buffalo in the United States, together with several hundred horses being trained for Federal service and more than a thousand head of cattle, were imperilled in Utah. Collieries and stocks of tobacco and fertilizer also appear in the reports as being damaged or endangered. We learn from an article from the *Toronto Star* of September 1st, for a copy of which we are indebted to the courtesy of our member, Mr. M. E. H. Sailman, that 26 fire-fighters were ringed about with flames and only escaped with their lives after terrible privations in fighting a fire caused by the careless dropping of a lighted match on the shore of Kalamalka Lake, B. C., in July last. During the same month, in the same province, 11 men lost their lives, mostly tortured to death, as they struggled over the mountain tops. The beginning of that disaster was a small piece of lighted tobacco carelessly thrown on the grassy floor of a tent. The prevention of forest fires is not simply an economically desirable undertaking; it is a task laid upon us by the dictates of common humanity.

Fire and Accident Prevention Day, 1917.

The exceptional circumstances of the year presented a somewhat difficult problem to the *Committee on Fire and Accident Prevention Day*. While it was clear, on the one hand, that no effort for the reduction of the national fire and accident waste ought to be abated at the present time, there was, on the other hand, considerable reason for doubting whether, amid the great variety of calls for public service, it would be possible to mobilize sufficient public interest and energy for the successful celebration of October 9th along the lines heretofore adopted. After careful consideration, it was decided not to issue any poster this year, but to proceed with the preparation of a booklet of suggestions for the various organizations likely to interest themselves in fire prevention, the suggestions being printed by way of introduction to the "Fire Prevention Day Programs" which had done good service in the past, and were now re-issued with minor alterations. The accident prevention field was left in the hands of our friends, the National Safety Council, who also were instrumental in distributing a number of the fire prevention handbooks.

The policy of issuing no poster for general use was justified by the event, as numerous special posters were put out by local organizations which were able to make direct appeals based on local interests and at the same time to give advance publicity to their own programs. The Chicago poster shows a homeless family watching the destruction of a cottage, and announces the great open-air meeting planned for Grant Park on the evening of October 9th. Incidentally it draws attention to the fact that the museum of the Chicago Historical Society contains many interesting relics of the great fire. In his large poster for Pennsylvania, Fire Marshal G. Chal Port (Member N. F. P. A.) makes effective use of pictures of conflagration-breeding conditions obtaining in his own State. Fire Commissioner Arthur E. Fisher, of the Province of Saskatchewan, Canada, in another most effective illustrated local poster, drives home his warnings by citations of facts regarding the fire waste of the Province. Governor Pleasant's Proclamation, which was issued as a poster in Louisiana, adds a touch of local interest to a national cause by mentioning that the annual fire loss amounts to the value of a year's cotton crop. The Batavia (N. Y.) Fire Department was responsible for a poster setting forth the immensity of the fire waste in terms of aeroplanes, base hospitals, interest on Liberty Loans, and the care of the millions of children rendered destitute by the war. This poster performs the useful function of notifying to all and sundry the telephone number of the department. We are also glad to notice a striking poster of the Boston and Maine Railroad naming October 8-13

as fire prevention week on that line, and containing several valuable instructions for the reduction of fire hazards.

Turning to publications of smaller size, we find quite a batch bearing the signature of our member, Insurance Commissioner James R. Young, of North Carolina. These include "Pledges for the Protection of the Home" (a variant upon the usual "Dont's") and a suggested program for school exercises. The Superintendent of Public Instruction in this State circularized the superintendents and teachers of the public schools, and the Commissioner himself wrote what he calls a "heart-to-heart talk" to city and town officials regarding building permits, inspection of buildings, electrical inspections, and efficiency of fire departments. The plan of observance drawn up in pursuance of Mayor Lysle's Proclamation in the City of McKeesport, Pa., presents one or two points of exceptional interest. Under the direction of a Committee of Civic Bodies a schedule was drawn up, providing for attention to be given to various specified hazards on the Friday, the Saturday and the Monday preceding Fire and Accident Day, on which day all premises were to be thoroughly inspected or re-inspected. A program of this kind has the great advantage of prolonging the period of concentration upon the fire waste.

Mr. Fredrick V. Bruns, of Syracuse, Chairman of the Fire Prevention Committee of our member, the National Association of Insurance Agents, is responsible for a new and ingenious method by which fire prevention is kept prominently and concretely before the public mind during a whole month. The citizens of Syracuse were invited by the Bruns office to watch the local newspapers for reports of fires occurring in the city between September 9th and October 9th, to make clippings and paste them on sheets of paper, writing opposite to each report how the fire, if preventable, could have been prevented. The sheets of clippings thus annotated were submitted by Mr. Bruns to the Chief Engineers of the State Bureau of Fire Prevention for adjudication, and prizes of $25, $10 and $5 in gold were awarded for the three best lists. It would hardly be possible to take part in such a competition without obtaining the beginnings of an education in fire prevention, and we should like to see this experiment tried in other cities next year. The competition was advertised, by means of small posters and in the city papers, as a "Contest, Open to Everybody, to Help Make Syracuse a City Free From Preventable Fires."

Among other publicity material we notice a small folder issued by our member, the Louisiana State Society for the Reduction of Fire Waste and bearing the alluring title, "Germany's American Ally." The art with which the fire prevention moral is intertwined with other matter in this pamphlet secured for it a reading, we imagine, by many who could not have been reached by a conventional fire prevention appeal. Good work in the distribution of Governors' Proclamations and circulars was done by the fire marshal's office in many states. We have already received specimens of such literature from the fire marshals of Louisiana, Michigan, Pennsylvania, South Dakota and Texas. In many places the efforts of state authorities were supplemented by local publicity. A half-page advertisement, containing cautions as to fire and accident

hazards, appeared, for example, in the *Hudson Observer* on Monday evening, October 8th, in connection with the celebration in the communities of Hoboken and Weehawken, N. J. Readers were urged to cut the advertisement out and to paste it up "in the most observable place" on their premises. Proclamations by the Mayors of Hoboken and Newark, N. J., have also come to hand. Besides the large poster already mentioned, the Boston and Maine Railroad issued to its employees an illustrated bulletin analyzing the causes of fires on the road in 1916 and embodying detailed instructions for the improvement of hazardous conditions.

Probably an important factor in making the observance of October 9th so general as it seems to have been this year was the letter addressed to the Governor of each State by our member, the National Board of Fire Underwriters. The effectiveness of this letter was undoubtedly enhanced by the activities of the National Board in the conservation of the resources of the country, and the result was very gratifying. The National Board also issued a special bulletin of suggestions for the observance of October 9th, very much along the lines of those recommended in the N. F. P. A. booklet.

Detailed reports of local observance have not yet been received in such large numbers as had been hoped, but it is already certain that a great amount of valuable propaganda was accomplished. A large number of copies of our booklet was distributed by the State Defense Council to the various Home Defense Committees throughout the State of New York. From Pennsylvania come accounts of elaborate observances at Reading and Lebanon. In both places public meetings were held, and the assistance of the Fire Marshal's Office and of the State Department of Labor and Industry was obtained in providing speakers; in both places special folders were distributed and the active co-operation of the firemen was secured in the matter of addresses in the schools. At Reading there was also an impressive parade of the fire department, and a really astonishing amount of newspaper publicity was secured. It is noteworthy that the local Chambers of Commerce were active in both these celebrations. Mr. G. E. Stecher (Member N. F. P. A.) has been doing pioneer work at Weehawken, N. J., where Fire and Accident Day was well taken up by the churches, the schools and the press. Chief Howard S. Rodgers, of Jamestown, N. Y., commenced his publicity campaign in the local newspapers a week in advance, and secured the promise of an entire page devoted to the fire prevention cause from the *Jamestown Evening Journal* and the *Morning Post*. Without neglecting the general hazards, special stress was laid in the Jamestown observance this year upon the inspection of chimneys. In the Boston Metropolitan District, Fire Prevention Commissioner O'Keefe issued a special appeal on October 9th for the co-operation of all citizens in his efforts to conserve the necessities of life through the elimination of hazards of storage.

Two celebrations reported present features of unusual instructional value. As far back as July, the special committee appointed to take care of the observance of October 9th in Chicago got down to work, and apportioned its labors among no less than fourteen committees as

follows:—(1) *Inspection and Civic Action*—to direct the work of any clean-up or paint-up campaign that may seem necessary; (2) *Schools;* (3) *Churches;* (4) *Organizations and Societies;* (5) *Women's Participation;* (6) *Motion Picture Industry;* (7) *Public Utilities*—to direct the work of interesting the various groups specified; (8) *Parade and Displays;* (9) *Public Meetings;* (10) *Speakers;* (11) *Publicity;* (12) *Resolutions;* (13) *Finance;* (14) *Printing and Purchases* (including banners, buttons, etc). By thus dividing the work, a thoroughly comprehensive observance was carried through. Special fire and accident prevention programs were arranged in all the public and parochial schools, an inspection blank was given to each pupil in the fifth, sixth, seventh and eighth grades, to be returned filled out within 30 days. The blanks, which were so worded as to indicate the remedies for defective conditions, will find their way eventually to the office of the State Fire Marshal. They are also being used as a text in the evening classes for adults studying the English language. The clergy preached on fire and accident prevention, and many of the church bulletins and publications contained articles on the same subject. Through the Committee on Women's Participation, nine Women's Clubs are known to have arranged special fire and accident prevention programs. Slides calling attention to October 9th were displayed at the motion picture theatres from October 4th on. Suitable posters were displayed in street cars, on Elevated stations, and in business and railway freight houses. A meeting was held in Orchestra Hall (admission by ticket). The house was full, and the program included, besides the speeches, a concert and a motion picture display. Other functions arranged were a Reunion of the Fire Fighters of 1871 in conjunction with the Retired Firemen's Association; a meeting on October 8 of the Western Society of Engineers, addressed by our members, Mr. W. C. Robinson, Mr. Frank D. Chase and Mr. C. W. Hejda; a luncheon of the City Club of Chicago; the opening of the New York Central Railroad's safety and motion picture car to visitors at the La Salle Street Station, and the keeping of open house by the Chicago Historical Society, whose valuable collection of relics of the great fire has already been mentioned. As a climax to the day's activities, a mammoth open-air meeting, accompanied by a band concert and motion pictures, was planned to be held at Grant Park, on the Lake Front, but owing to the bad weather this had at the last moment to be abandoned.

The other celebration selected for special comment is that at Oshkosh, Wis. In this case the success achieved was mainly due to the energy and public spirit of the Business Women's Luncheon Club—a fact which is of peculiar interest to the Association, inasmuch as it has made special efforts this year to secure the co-operation of women's clubs. Some responses were received—notably from the members of the Conservation Committee of the Minnesota State Federation—but so far as is at present known, Oshkosh and Chicago are the only cities in which organized women took a prominent part in the work. At Oshkosh the Women's Luncheon Club lined up the merchants and manufacturers, the credit men, the fire insurance agents, the Council of Defense, the Board of Education, and the Twentieth Century Club;

secured the co-operation of the Commission Council and Fire Department, and arranged a Fire and Accident Prevention Week. Some readers may recollect the fire and accident prevention window display arranged by the Industrial Commission of Wisconsin and the State Fire Marshal last year—a photograph thereof was reproduced on page 250 of the QUARTERLY for January, 1917. A very similar display was prepared at Oshkosh this year, with the addition of exhibits of mechanical devices. The assistance of our member, Mr. Sidney J. Williams, as a speaker was obtained; "safety" motion pictures were shown at all the local theatres; a public demonstration was given by the fire department; and appropriate exercises were arranged in the schools.

From the numerous requests for literature received from teachers, it is clear that a large amount of quiet work was accomplished in the schools throughout the country. At Norwich, Conn., it is interesting to note that Chief Howard Stanton reversed the usual order of things by granting permission to the teachers of two schools to inspect the central fire station with the children, who were there addressed by the Chief.

Just as we go to press we receive copies of a small poster, "Your Duty—Help Uncle Sam Prevent Fire," of which 3,000 copies were distributed by the Cleveland Chamber of Commerce. News also comes to hand of good work started at Seattle and Spokane, Wash., and at Pueblo, Colo., in all of which cities bigger results are planned for 1918, when the task of organization will be taken in hand at an earlier date than was found practicable this year. Doubtless there are still many reports in transit, but even if nothing more was accomplished than has already been reported, the fact that Fire and Accident Day has received so much recognition amid the distractions of this year augurs well for the future.

Individual Liability for Fire Loss.

Interesting Court Decision Affecting Liability of Property Owners.

The attorneys-general of a number of states have given the opinion that under the common law a person is liable for damages to his neighbor's property resulting from a fire communicating from his own premises where such fire is the result of his negligence or that of his servants. If a man injures his neighbor's motor car by careless driving he is at once accounted liable; such liability is commonly accepted and understood. The only reason one injured by fire through his neighbor's carelessness is not equally quick to claim indemnity, is that custom has not stimulated him to apply the common law principle to such cases. All fires have been considered misfortunes, and as most property is insured and the loss thereby distributed over a large number, the principle has been obscured, and carelessness and irresponsibility thus condoned, if not entirely ignored.

The National Fire Protection Association has urged its members to induce persons injured by fire from negligence of others to bring suit for damages under the common law. Every such case that is tried has a salutary educative value, and any case of that sort won by the plaintiff serves to establish the well-known principle in this new and desired field of its application. Such a case just decided in the U. S. District Court of Maryland affords so clear a statement of the arguments to be expected in such litigation, as to make it of great value as a reference in similar cases which may be brought.

According to the *New York Law Journal:*

In The Willem Van Driel, Sr., and The Welbech Hall, in the U. S. District Court, D. Maryland (April, 1917, 242 Fed., 285), it was laid down that a fire caused by the negligence of a defendant or his servants is not "accidental" in such sense as to exonerate him from liability for injuries caused thereby to others.

It appears that the respondent operated on a pier a large grain elevator, 240 feet long, about 100 feet wide and 180 feet high. In it were six so-called receiving legs extending from the track floor to the top, in each of which ran a wide conveyor belt with buckets for carrying up grain passing over a large pulley at the top. While a steamship was loading on either side the elevator took fire, and there was an explosion causing the death of a number of persons and serious damage to the vessels and cargoes before they could be removed. One of the conveyor belts had become choked and stopped, and some five minutes later dropped, the pulley at the top continuing in the meantime to revolve. The only place where the choking could be observed was on the track floor, while the only means for throwing the belt out of gear was a lever on the machinery floor 152 feet above. There was a considerable delay before this lever could be reached, and it was then found that it was out of repair and would not work. The

machinery was stopped, but in the meantime the belt had fallen. There were originally ropes extending down to the track floor by which the levers could be operated, but they had been for some years out of use and some had been removed. It was held that the damage to the ships and cargoes was the proximate result of the burning of the elevator, and on the evidence that the fire was caused by the friction between the belt and pulley, that it was due to the palpable negligence of the elevator company in failing to provide means to obviate a danger so obvious, and that it was liable therefor. The court said in part:

"I do not think there can be any reasonable question that the fire was caused by the friction between belt 3 and its pulley. It spread from No. 3 along the shafting and through the legs before it was discovered, either because no one was at the time on the machinery floor or the top floor, or because, if the oiler who lost his life was there, he was in some part of one of those floors remote from the place at which the fire started, or was otherwise so engaged that he did not notice it until it had gained great headway. There is no other known cause for the fire. All the conditions are consistent with its having so originated. Respondents say that, even so, they are not liable. They rely upon the Statute of 6 Anne as amended by that of 14 George III. They did not seek to set fire to the ships. Neither they nor their servants wanted to start a fire at all. They cite the well-known passage in First Blackstone Commentaries, 431, to the effect that any fire is accidental within the meaning of the statute which was not a willful act of the person sought to be held for its consequences. They point to the approval of this construction by Lord Lyndhurst in his remarks upon Lord Canterbury's petition of right (First Phillip's Chancery Reports, 306), and to the fact that it was followed and applied in Lansing vs. Stone (37 Barb., N.Y., 15); but both the English and American Courts have definitely rejected this interpretation, and upon full consideration have held that a fire caused by the negligence of the defendant or his servants is not accidental within the meaning of these statutes (Filliter vs. Phippard, 11 Add. & Ell., N. S., 346; Webb vs. Rome, Watertown & Ogdensburg R. R., 49 N.Y., 420, 10 Am. Rep., 389; Rogers vs. Atlantic, Gulf & Pac. Co., 213 N.Y., 254, 107 N. E., 661, L. R. A., 1916A, 787, Ann. Cas., 1916C, 877; Hoffman vs. King, 160 N. Y., 622, 55 N. E., 401, 46 L. R. A., 672, 73 Am. St. Rep., 715; Lillibridge vs. McCann, 117 Mich., 84, 75 N.W., 288, 41 L. R. A., 381; 72 Am. St. Rep., 553).

"Many of the numberless cases in which railroads have been held to answer for the damage done by fire set by sparks negligently allowed to escape from their locomotives may perhaps be put on one side, because in many States special statutes recognize, define or impose liability under such circumstances.

"The respondents reply that if so much be admitted it does not follow that they are liable. They claim that, whatever may be the language of the opinions relied on by the libellants, the fires actually dealt with were in nearly every instance purposely started, although for a proper or at least for an innocent purpose, and the negligence for which the defendants have been held responsible consisted either in recklessness in starting the fire under the physical conditions existing or in a lack of reasonable care to prevent the fire getting beyond control. In other words, that the real reason why liability was imposed was that if defendants saw fit to make use of a dangerous element they were bound to be careful to keep it from harming other people. They argue that there is nothing which has been actually decided inconsistent with a construction of the acts of Anne and George which will relieve every one from liability for the consequences of a fire which he did not intend to start, but which was started as the result of his negligence or that of his servants. In support of this contention, they point to the fact that, while lack of due care has caused countless fires, the cases are few in which so much as an attempt has been made to hold any one liable for their consequences. The fact as stated is undoubted and has often been commented upon, as in the notes to First Cooley's Blackstone, 431. It is doubtless true that both courts and juries realize how easily one may be guilty of some act of momentary carelessness which may cause a fire and involve a destruction of other people's property, which even the absolute financial ruin of the negligent one could not make good. They are reluctant to hold him liable unless his carelessness and the consequences are both clear. Even then they have sometimes

sought to restrain the extent of his liability by laying down some rather artificial limitations as to the damages which they will consider the proximate consequences of his negligence (Ryan v. N. Y. C. R. R., 35 N. Y., 210, 91 Am. Dec., 49; Penn. R. R. v. Kerr, 62 Pa., 353, 1 Am. Rep., 431). But in so doing the Supreme Court and the weight of authority in other States hold that a mistake was made (Milwaukee R'y v. Kellogg, 94 U. S., 474, 24 L. Ed., 256). The courts have sometimes been asked to make the distinction contended for by the defendants, but they have always refused to do so (Vaughn v. Menrose, 3 Bingham, N. S., 468; Norris v. Holt-Morgan Mills, 154 N. C., 474, 70 S. E., 912).

"There can be no question that the damage done to the ships and their cargoes was the proximate and, indeed, under the circumstances the necessary result of the fire in the elevator. The ships were at its side by the invitation of the elevator company, and for its profit as well as theirs. It knew that any fire which started in such a structure was likely to spread with a rapidity that injury to vessels made fast to the pier was the not improbable result, if a fire within the building once got headway.

"The question remains as to whether the probability of a fire being caused by the friction between a choked belt and its pulley was great enough to make the elevator company, because of its failure to use the ordinary means of preventing such friction, liable to the libellants for the consequences of the fire. This question raises an issue of fact, in a common-law case for a jury, and in this for the admiralty judge. In passing upon it, all the facts and circumstances must be taken into consideration. Blackstone construed the statutes of Anne and George as he did because he thought the one on whose premises the fire started suffered enough by the damage done his own property without requiring him to make good that which the fire caused his neighbors. It is difficult logically to reconcile this reasoning with accepted legal principles, but it has a good deal of human nature in it. Everyone who is called upon to pass upon such an issue as that now presented is likely, consciously or unconsciously, to feel a strong sympathy with it, none the less that the claim will often be made not for the person whose property has been burned, but by the underwriters who have compensated him for it, and who, if anybody had thought of asking them to do so, would doubtless for a small premium have insured against any possible consequences of defendants' lack of care. Nevertheless, I cannot help feeling that in this case the negligence of the elevator company in the respect discussed was palpable and that the consequences to which it in fact led were those which might reasonably have been anticipated from it and doubtless would have been had it so happened that the elevator company's officers had ever given thought to the subject. I doubt if they ever did, but, while it is easily understandable how it was that they did not, nevertheless legally they should, and, as they did not, their company must bear the loss."

The reference of the court to the construction of Blackstone touches the notion in the public mind which has done so much to perpetuate fire hazard conditions and personal irresponsibility therefor —that he who has a fire suffers enough himself and ought not therefore to be held liable for his neighbor's injury. This, as the court says, has "a good deal of human nature in it." But apply the principle again to motor cars: if the reckless driver smashes his own car when he smashes yours, are you inclined to condole with him?

Loss of Life from Common Hazards.

In continuance of the list started on page 30 of the *Quarterly* for July, we now reprint a further batch of newspaper clippings, showing by concrete examples how common fire hazards unexpectedly work ruin in the lives of ordinary people. As explained previously the idea of making such a collection is to provide effective illustrations for those who have occasion to argue the case for fire prevention before those who pay little attention to statistics or who are inclined to think that the fire menace is of little importance in every-day life. For some of these clippings we are indebted to the courtesy of members of the Association, but the majority were made in the Executive Office. Members can render much help by sending in clippings from the local papers dealing with such occurrences in their own communities.

MANCHESTER, N. H., May 13.—Four persons lost their lives and more than a score escaped in their night clothes in a fire which destroyed the Weston and Fitts mercantile and apartment building on Elm street, early today. The loss was estimated at $200,000. The dead are Miss Jennie Moffit, 60 years of age, whose body was found in her room on the top floor of the building; William Hickey, 50 years, a mill operative; Omar Godbou, also an operative, and John Shaw, 50 years, a furniture dealer, who died of heart failure during the fire. The lower floor of the building was occupied by stores and the two upper floors by apartments.

JEFFERSONVILLE, Ind., May 15.—Mrs. Robert Mull, 22, wife of a Borden, Indiana, farmer, was fatally burned and her three children, one, two and three years old, were cremated today when their home was burned. The fire was caused by a coal oil can exploding while Mrs. Mull was starting a fire in the kitchen stove.

MINERSVILLE, Ohio, May 20.—One of the most horrible catastrophes that has saddened the lives of the citizens of the Pomeroy Bend occurred about 6 o'clock Sunday morning at Minersville when the home of Joseph Betzing burned to the ground with all its contents, snuffing out the lives of Mrs. Betzing and their six children.

According to Mr. Betzing, he left his house about 5 o'clock to go to the river to look after some trot lines and to fish. He waited for his brother for a half hour or so and they together went to the river. Before leaving the house he blew out the lighted oil lamp. Shortly after reaching the river he heard an explosion and looking toward his home saw it in flames. He hurried back but when he reached there it was impossible to render any assistance to his unfortunate family. The flames from the Betzing home set fire to the home of Watt Thomas which was also destroyed. By heroic efforts of neighbors the house of Alonzo Custer next to the Thomas home was saved. The wind being favorable was all that prevented the burning of the home of Grant Hood.

Just how the fire started will remain a mystery, but one theory is that the flame of the lamp was not extinguished when Mr. Betzing thought he had blown it out and that the bursting of the lamp caused the holocaust. It is also thought possible that Mrs. Betzing arose and attempted to light a fire in the kitchen stove, using oil (or possibly gasoline by mistake) and that she was too badly injured by

the resulting explosion to escape or give an alarm. The stove was found tilted up on the rear end, as if thrust that way by an explosion, before it was dropped to the ground by the burning away of the floor.

ROSEMOUNT, Minn., June 16.—Mistaking a can of gasoline for one containing kerosene, Mrs. Herman Oshman, wife of a farmer living near Rosemount, Minn., poured some of the fluid on the wood in a stove, and touched a match to it. In the resulting explosion Mrs. Oshman was mortally burned.

DEADWOOD, S. D.—Mr. Walter Wheaton died recently as the result of burns sustained in a gasoline explosion in his home in Deadwood.

TURNER, Ore.—Lenore Simmons, 8-year-old daughter of Mr. and Mrs. J. D. Simmons of Turner, Ore., died at the Portland sanitarium from the effects of burns received when her clothes caught fire from a gas stove.

NASHVILLE, Tenn.—By the thoughtlessness of Miss Ida Jarman, a trained nurse at the Shoffner Hospital, Nashville, Tenn., she and Miss Beulah Pate, another nurse, are dead. Miss Jarman went into the hospital supply room to fill a bottle with alcohol. Instead of using the electric switch within easy reach, she lit a match, and threw it to the floor. Still burning, the match ignited with the alcohol barrel, and an explosion followed. The two nurses in the room perished. Twenty patients, some critically ill, were forced to leave their beds and were carried into the streets. The damage to the hospital building was around $750.

DOUGLAS, Ariz.—Douglas Ballard, of Douglas, Arizona, washed his trousers in gasoline. After his labor he put on his nice clean trousers, took out a cigar, with the best intentions of a fine smoke. If he had not used those nice clean trousers for a match scratcher he undoubtedly would have had a satisfying smoke, and in all probability the physicians would have had no opportunity to pronounce his burns fatal.

WINDSOR, Ont., Sept. 24.—Mrs. Bridget Mooney, 45 years old, wife of Charles Mooney, farmer, of Maidstone, 12 miles east of Windsor, and her daughter, Mary Alven Mooney, aged 10, died this morning as a result of being burned Sunday night when an oil stove exploded.

Mrs. Mooney was washing her daughter's head, using coal oil in the water, according to members of the family, when some of the oil spilled near the stove. Immediately the girl, who was seated near the stove, was enveloped in flames, which spread to the clothing of Mrs. Mooney. Both ran into the yard, after a younger daughter had attempted to extinguish the flames by throwing water on them. Their cries attracted the husband, who wrapped them in wet blankets. They received medical attention, but both were so badly burned that recovery was impossible.

LEXINGTON, Mass., Sept. 25.—Woodrow Wilson Fleming, four and one-half years old, the youngest son of Mr. and Mrs. John F. Fleming of 38 White Street, West Somerville, was burned to death in the Fleming summer cottage at Bellflower and Freemont Streets this afternoon, and the cottage was destroyed.

Mrs. Fleming and the baby were at the cottage alone at the time. The baby was sleeping upstairs and Mrs. Fleming was downstairs doing the housework. She had just lighted an oil stove when she was attracted by a neighbor's cat outside the house trying to catch one of the chickens. When she had scared the cat away she looked back and saw black smoke issuing from the cottage.

She rushed back into the building, now blazing fiercely, and attempted to get up the stairs, but they were so badly burned that they gave away under her. She barely escaped through the door as the flames belched toward her. The child's body, burned and charred beyond recognition, was found by firemen among the embers later. The fire is believed to have been started by the oil stove exploding. Mrs. Fleming was hysterical and was placed under the care of a physician.

The following extract from an article appearing in a recent issue of the *National Underwriter* is also of interest.

"According to a recently issued report of the Indiana fire marshal that official received during one week reports of the death of two women, and of serious

injuries to several others, due to carelessness in the use of kerosene and gasoline. One of the women wanted to hurry up the fire in her cook stove, and thinking the fire was out, started to pour kerosene on the coals. It was the old story—there were some live coals, the kerosene exploded, enveloping the woman in flames, and not only caused her death, but also destroyed the house.

"The other woman wished to clean some clothes, according to the report, and threw a cupful of gasoline into a boiler of hot water. The gasoline instantly flashed, throwing the flames in all directions, resulting in her death before help arrived."

We conclude with extracts from an instructive memorandum written by our member, Mr. Sidney J. Williams, upon a fatal fire which occurred at Eau Claire, Wis., on 12 May, 1917:

"This fire occurred in a small two-story frame building, of which the first floor was used for business purposes and the second floor for living purposes. At the time of the fire the second floor was occupied by Mrs. Alice Meservey, her four children, her sister, her mother, and one roomer, a total of four adults and three children. The fire started at the foot of the stairway and spread rapidly. The adults, sleeping in rooms farthest from the fire, were rescued through the windows, together with one of the children. The other three children were killed, as was also a young man who tried to rescue them. The fire did not reach the children, but they were killed by inhaling smoke and gas. Two of them were found in their bed, having died without waking, the third was found on the floor a few feet from the bed. The room had a window opening upon a low shed, which would have made escape easy if the children had been awakened in time to reach the window. . . . No matter how many exits such a building may have, they are of no value if a fire spreads so rapidly that the occupants are suffocated before they can reach an exit.

"The most important things in a building of this type are, first, the heating and lighting apparatus, and other possible causes of fire, and second, the presence of paper, rubbish, or other combustible material which helps a fire to spread rapidly. To this may be added the importance of cutting off vertical openings where possible, and especially the enclosing of stairways in the basement, where the greatest hazard lies."

Public Utilities and Public Health.*

By H. E. Barnard

Golden apples no longer load the public utility apple tree. There was once a time when it was the stockholders' delight to gather in the orchard when the board of directors shook the tree, but those days are gone, and today it is the exceptional tree that will yield its expected 6 per cent. The fortunate owners of utilities before the days when commission pests and board of health codling moths made the crop of golden fruit hard to grow and most difficult to gather, are, like other orchardists, prone to bewail the sad state which has come upon them and deplore the heavy expense to which they are put to make the tree blossom, to say nothing of the continual struggle to mature the crop after the fruit has set. But, coming out of the orchard, where metaphors may please but fail to enlighten, we find the public utility of today charged with a double duty. It must render service to those whom it presumes to serve. It should also return a fair profit to its owners. And the first duty is the greater.

I shall confine my analysis to the public utilities known as water companies, and I shall make no distinction between companies owned by stockholders in distant cities or municipal plants owned by the consumers. In each case the duty to the public is the same. If in the fulfillment of that duty the stockholder suffers, he is entitled to sympathy, perhaps commiseration, for the lack of judgment that allowed him to invest his money in a business where the first and last concern is service to the purchaser of the product.

Thirty years ago the water company worked under different conditions. Public opinion was uncrystallized and courts interpreted the law with no idea of what we now call social justice.

Then the consumer drank water at his peril; today he drinks with the assurance that if he is injured by his indulgence the water company will compensate him for his illness or his family for his death. There is no question as to the law or the interpretation of the courts. It is an accepted principle that when a man engages in the business of selling food he assumes all the risks. If by his act or by the act of his servant a customer is injured, he must be responsible. And the law is the same for the water company as for the butcher. Both are in the business of selling food, for water is a food and so recognized by all federal and state food legislation.

It is unnecessary to point out the danger of drinking polluted

*Read before the Illinois Section, American Water-works Association.

water. That has long since been recognized as a first principle of sanitary science. Pure water is safe water. Polluted water is dangerous. Health authorities recognize their responsibility in the protection of water supplies. Many states have special departments which regulate water supplies as public health measures. Indiana exercises a supervisory control over all waters, public and private, through the laboratories of the State Board of Health, and has not yet conceded to the Public Utility Commission its complete authority over the operation of water supplies in matters which concern the public health rather than the public pocketbook. Illinois handles the matter even more directly through its State Water Survey, and, the author would add, most successfully. Responsibility is fixed and means are provided so that Dr. Bartow and his assistants may not only safeguard the public, but at the same time furnish the water companies with most valuable assistance, and this, in the author's opinion, is the ideal organization. An efficient police department is worth while, but constructive work that in the end makes the policeman unnecessary is far more desirable.

And yet in spite of law, court decisions and plain horse sense, there are still in operation water companies that conceive their purpose in life to be pushing water through pipes and, that accomplished, they claim their reward. In Indiana, and it may be true in Illinois, there are superintendents of water companies on the salary list but not on the job who, so far as can be learned, have never heard of the rights of the people to pure as well as fluid water and who also regard the fire chief as a much more important personage than the health officer. Fire protection is a function of a water supply. No doubt many towns would still be using wells if the fire hazard did not compel the laying of water mains and the installation of hydrants. But as soon as the tap is turned on in the kitchen the situation changes, and the primary duty of the water company is not to maintain pressure for fire protection, but to pump food through its line, and, above all, food that is sure to promote health and not to breed disease.

Now, then, where are we? We are up against the incontrovertible fact that a water supply, save in a few unusual instances, is an object of suspicion. There may have been a time when surface waters were pure, when our lakes and ponds were uncontaminated by the wastes of civilization. But that time is long past, no stream is so remote that it may not be polluted, no pond so protected that it is surely safe. The water company must operate a plant to make unsafe waters dependable in addition to the pumps which were once, and unfortunately still are, the superintendent's chief concern.

From the public health standpoint, and the author maintains that is the all-vital consideration, fire protection is a secondary and minor function. And yet last July an engineer for a water company in an Indiana city, when confronted by the demand of the fire chief for more water with which to fight a serious fire, turned into his mains the water of a grossly polluted river. After such criminal action, for it was criminal in the same degree as the act of the guard

who throws open the city gates at the demand of the assaulting enemy, the officials called upon the state board of health for advice.

What we want, what we must have, is a trained, responsible man in every water company who will seek advice first and act only after the community knows what confronts it. The author is not sure that the disaster of fire is ever as menacing as the scourge by typhoid, or that there can arise a situation in which a water company will be justified in filling its mains with polluted water, but if such an occasion should confront the water company, its first act should be to protect health by complete warnings.

As water companies have assumed the responsibility of pumping pure water, they have added additional defences against bacterial contamination. Filter beds, no matter how efficient, are supplemented by chemical treatment. The almost universal use of hypochlorite, or chlorine, protects the consumer and breeds in him a faith that is the greatest asset of the water company. But chemical treatment is only efficacious when it is working. When no chlorine is entering the water the supply is as dangerous as before the plant was installed; indeed, it is more dangerous, because the faith of the consumer has stopped his practice of boiling his drinking water.

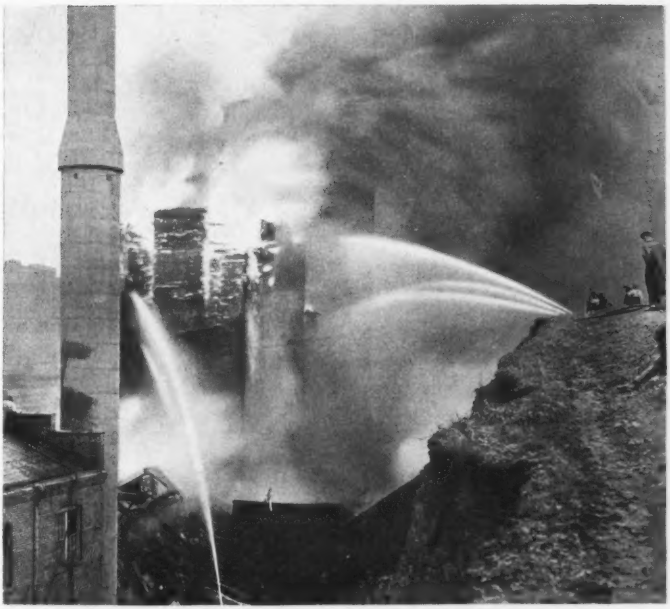
Within a year four Indiana plants operating chemical purification installations have on at least one occasion stopped the chemical purification for a period of from two days to two weeks and without advising either the health officer or the consumers of their action. The reason given was: "We ran out of chemicals, and it was several days before we could get more." So far as the author is informed, the impossible, inefficient, untrustworthy men who ran out of supplies are still on the job, or at least as much on the job as the sentinel who sleeps at his post can ever be. As damnable as was the neglect of the individual which might have sent typhoid raging through the city, the failure of the "higher-ups," the city officials, the officers of the water company, to appreciate the blood guilt of the subordinate demands even more caustic criticism.

All the consumer got, all the health officer received, were excuses. "The orders were in, but the hypochlorite didn't come." "We didn't realize how short we were." "No trouble came of it, anyway, so what's the howl about?" When an officer of the armies that are sowing the fields of Europe with mangled men gives his superior such an excuse for failure, he knows that the only answer will be that of the firing squad that hustles him into his freshly-dug grave. The responsibility of the man at the pumping station is as grave as that of the officer on the battle field; graver, for the lives of hundreds and thousands are in his keeping, not alone in a single battle, but night and day, every day in the year.

Now this is an admitted fact. There are no "maybe's" or "perhapses" to the premise. When a water company sells water it guarantees that water to be pure, it pledges itself to know that it is pure. Why, then, does every political change, petty shifting of civic responsibility from incompetent shoulders to others more or less incompetent, mean a change at the water-works? Why does the

job go to some party follower or relative of the mayor, who wouldn't recognize a colon bacillus if it was as big as a toad, and whose only idea of service is the record of the pressure gauge? We, the consumers, are asleep; we, the health officers, are bound by precedent or fearful of overstepping our authority; we, the press, are partisan and indifferent; we, the chambers of commerce, are sworn to do nothing that will arouse fear or hurt business.

Paraphrasing Patrick Henry: The price of safety is eternal vigilance. Consumer, health officer and every civic organization, realizing that pure water is not only a personal right, but a public asset, must work together to put the waterworks into the hands of trained, dependable experts, and, having chosen wisely, to demand full service. Not until then can we count on the public utility in the form of the water company to render dependable service in protecting the public health.

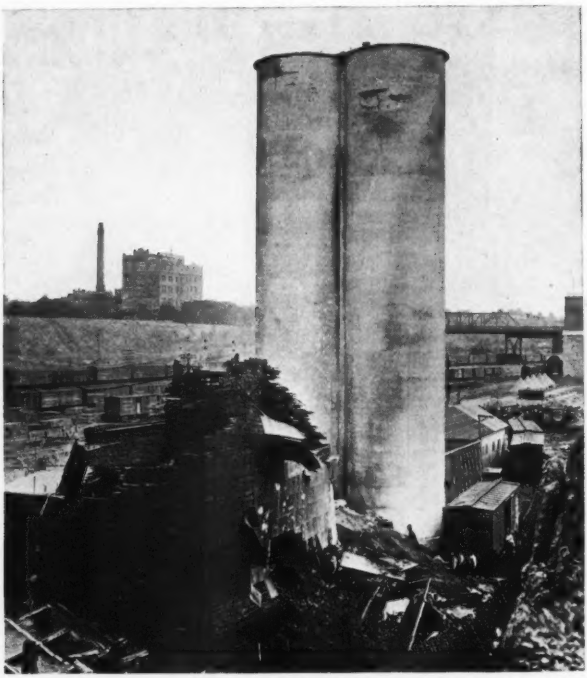


Shows fire exposure of grain tanks.

Concrete Grain Tanks in Severe Fire.

Sunday, May 27, 1917, at 2 p. m., fire broke out in the plant of the Maney Milling Co., Omaha, Neb. This was one of the largest flour mills in the middle west. The elevator and mill building which were destroyed were of wood construction. Part of the elevator was covered with sheet metal. At the south end of the plant immediately adjoining the large elevator were two reinforced concrete grain tanks, built about four years ago. These are 150 feet high and were connected to the top of the elevator by a conveyor which was enclosed in a wooden cupola, or dust house.

The fire started in the top of the grain elevator. By the time the fire department arrived on the scene and commenced operations, the fire was beyond control. A strong wind was blowing and for five hours the intense heat and flames were concentrated on the concrete grain tanks, as the above illustration shows. At intervals water was thrown on the tanks. The fire continued for about 24 hours before finally put out. A careful examination of the concrete tanks following the fire disclosed that the only damage they had suffered was a small scaling of a thin coat of cement mortar. In no place were there any cracks nor signs of other failure.



Grain tanks after the fire.

The tanks had a capacity of 20,000 bushels each. At the time of this fire they were about one-third full of wheat. After the fire this was found to be in perfect condition except that on account of wooden doors instead of steel ones on the roof, some fire got into the concrete bins. This, however, did no damage to the concrete, and but little to the wheat.

The Hazards of Domestic Electrical Appliances.

By **W. J. Canada, Bureau of Standards, U. S.***

(Member N. F. P. A.)

Following the reading of this paper, and discussion generally showing the need of new efforts by municipal electricians along educational lines, a motion was made, and unanimously carried, pledging this Association to assist its members in conducting educational campaigns along the lines recommended in the paper, and appointing a committee to co-operate with the National Fire Protection Association, the Bureau of Standards, and other agencies in making such campaigns most effective.

When you invited the National Fire Protection Association to send a representative to this Convention to discuss the Hazards of Domestic Electrical Appliances it happened that that Association had been recently assisting the Bureau of Standards in preparation of a chapter on a very similar subject,—the Electrical Hazards of the Household,—which will shortly appear in a Bureau publication, available for household, school, and similar educational uses. At the request of Secretary Wentworth of the N. F. P. A., I am very glad to present this subject for your discussion here, and hope that your long experience, active study and constant contact with the electrical inspection problems will enable you to offer concrete suggestions mutually helpful to the National Fire Protection Association, the Bureau of Standards, and your membership in our common object—the reduction of fire and life hazards of electrical applications. The fuller attainment of this object, it may be proper to state, has its special bearing today on the pressing problem of conserving every resource to assure our successful conclusion of the war. Fire and life hazards are a serious and unnecessary drain on our resources.

Our purpose being to examine into our unsolved problems and our failures, rather than to felicitate ourselves on our many successes, I shall merely touch upon our degree of success in reducing and particularly in localizing the electrical hazard problems, then proceeding to a more detailed exposition of those things we have left undone as regards household hazards. It may be safely said, to the credit of our electrical inspection departments, which are unequalled in other countries, and no less to the credit of the elsewhere unequalled co-operation between all branches of the electrical industry, that our present electrical construction standards, both for fire and accident prevention, are the best in the world, and that our

*Address at Convention of International Association of Municipal Electricians (Member N. F. P. A.), September, 1917.

inspection of new installations is the best organized, most thorough and effective. To be sure, our use of standards until the very recent past has been limited to the National Electrical (Fire) Code. But its accident prevention counterpart, the National Electrical Safety Code, has now been in our hands for some time, has already demonstrated its suitability under extended field trial in all parts of the country, and is now available for those who desire to meet their accident prevention responsibilities as effectively as they have those for fire prevention. Except for some unavoidable tardiness in acquiring familiarity with new rules, we may soon hope to see inspection of *new* wiring in most of our communities well-nigh beyond serious criticism. In factories and stores which are at least occasionally reinspected and where, in any event, the observation of many persons exercises a certain salutary influence on the current electrical practices, even the older installations and their attachments show the good effects of the present inspection system by their comparatively low electrical hazard. Electricity used with discretion is truly the safest form of energy.

Having properly complimented ourselves on our past performances in fire prevention and our future performances in accident prevention as well, let us make a few sober and meek confessions of some of our failures. They are fortunately few, and no one is more concerned than we in obviating them. There is much merit, too, in making such confessions, as they always stimulate a healthy desire to avoid the necessity for repetition. And we shall find the cure for our failures, if we apply the same energy to any unsolved problems, that we are so successfully applying to our new wiring problems. That problems still exist unsolved our great annual fire and accident losses sufficiently prove. Let us examine the amount and location of these losses and the reasons for their continuance in spite of our past inspections.

The electrical fire loss is something like seven to eight millions annually, a small sum as national expenditures now go, but a very considerable and unnecessary tax, nevertheless, and even more serious when we remember how we must conserve every resource to meet those *necessary* national expenditures. High cost of living, too, has ceased to be a joking matter, and waste of resources adds to this cost. Our electrical accident loss is about 1500 lives and much disability, an annual drain on our economic resources of probably 60 millions. This is even more serious. We have not long had a far-sighted and well coordinated policy of education by accident prevention interests, such as the National Fire Protection Association has carried on for many years for fire prevention. It is evident that very much could undoubtedly be done in all sorts of simple ways to reduce the accident loss, and the standard for guidance is now available for willing or unwilling users. Such unanalyzed general statements on electrical hazards as the foregoing are not very useful in locating actual hazards. They serve usefully, however, in reminding us sharply of a serious leak somewhere in the protective inspections we are making. Where are these leaks?

A very slight examination will show for fires that the electrical wiring installation proper is concerned in only a fraction of the total electrical fire loss, new wiring hardly at all. Old, poorly maintained wiring contributes a good many fires, and the various electrical appliances, especially portable ones, make up the imposing rather than gratifying total. Yet we must admit that at least 75% of our inspection effort is now being directed toward supervision of new wiring, inspection of old wiring being usually a minor matter, and inspection of appliances highly infrequent and merely incidental. Possibly the relation between the numbers of such inspections and fires is a compliment to our inspections. It is certainly no compliment to our intelligence in the division of our activities.

Electrical injuries have not been minimized by the same long continued and well organized and directed inspection and application of standards as have fires from defects of installation. The standard is now in our hands, but we have applied it only to a most limited extent, and our unpraiseworthy inertia will retard the growth of anything like a full application of the Safety Code so long as we do not face our responsibility regarding electrical accident hazard, grit our teeth and really get to work earnestly and co-operatively to stop the injuries. Then we shall quickly make our accident waste as little as our present fire waste. The same earnest thought can be as successfully applied to the cutting in two of our present electrical fire waste. But we must be prepared to cheerfully change our present methods wherever upon examination it is shown that these, even if formerly adequate, are no longer so.

We must begin our redirected campaign against electrical hazards of all kinds by a closer analysis than heretofore of electrical accidents and fires and direct our main effort against the particular divisions and features of electrical practice most implicated. We have noted above that new wiring is comparatively free from fire hazard. Our very cursory examination of accident statistics will show electrical accidents to be largely due to overhead line failures and to the hazards of work about electrical lines and stations. With these hazards the National Electrical Safety Code deals adequately, and they are outside the scope of this paper. We shall rather confine our present thought to a study of electrical accident and fire hazards in ordinary homes, locations where both hazards exist, and where the wiring and equipment after installation comes under the use of the ordinary citizen. Householders are not electrically trained, and their attention is distracted from the electrical features by the other activities and processes occurring about them. To the householder, of course, electrical features of his household are mere incidents. For this class of user of electricity the greatest amount of safeguarding, physical and educational, must be thrown about the electrical wiring and equipment. Let us examine how much has been done in this direction—how much left undone, and what it is feasible yet to do in the direction of further safeguarding our intrinsically safest form of energy in what should be the safest place —the home.

The new installation in the home has several great intrinsic safeguards; it is of comparatively low voltage, probably 110 to ground, certainly not over 220; and the fixed wiring is usually all but entirely concealed from chance contact or disturbance. When it is last viewed by the inspector it is usually without attachments other than fixtures, and only a few considerable hazards or even serious opportunities for future hazards seem to exist. This, of course, describes the condition where a good inspection has been established, but even without regular inspection new house installations before being placed in use are comparatively clear of hazards. This, however, does not mean that there are no opportunities for future hazards. There are plenty of them. The fact that 80 to 100 fatalities and numerous burns and other injuries and thousands of fires, large and small, result annually from electricity in homes shows clearly that something happens after the inspector takes his departure, which very greatly increases the danger to householders from electrical causes.

The respects in which hazards appear in the household, practically unchecked by the inspector, and, indeed, only occasionally even seen by the inspector, are numerous but simple, and they may all be grouped into very few classes. The following short outline of household electrical hazards will probably meet your approval as a representative and fairly complete list. Most of the hazards, it will be noted, are such as arise after the inspector has, under the present average inspection system, served his somewhat inadequate turn, and the installation and equipment are left to the untaught mercies of the average citizen and his average family.

The principal electrical life and fire hazards which our present day inspection methods leave to increase and multiply in the home may be classified briefly as follows:

A.—Hazards of the Original Inspected and Approved Installations.

1. Open knife switches or other bare live parts exposing passers-by, users, and nearby combustibles.

2. Cutouts not enclosed to prevent communication of fire to nearby combustibles or having live parts exposed to contact during the removal and replacement of fuses.

3. Insulated wires exposed to abrasion, on side walls, posts, low basement and attic ceilings, and above joists in unfinished but more or less used attics.

4. Ineffectively grounded distribution circuits, where metal water pipes and other buried piping enters the house, but the circuits are grounded to an insufficient number of artificial grounds—driven pipes or otherwise.

B.—Hazards Added After Inspection and Approval.

1. Unnecessarily long cords; cords of any kind in place of fixed wiring; ordinary in place of reinforced cord.

2. Ungrounded brass-shell pendant and portable sockets often unbushed, as well as ungrounded lighting fixtures and motors within reach of plumbing or other grounded surfaces.

3. Portable motors, vibrators, pressing irons, chafing dishes and similar devices within reach of plumbing.

4. Overloading by unanticipated devices, pressing irons, motors and other devices on No. 18 fixture wire; several devices on one circuit, requiring overfusing; several devices on one socket.

C.—Hazards Due to Attachment of Interior System to Unexpected or Unusual Circuits.

1. Use of the smaller circuit wire, cords and fittings approved on inspection as suitable for 110-volt circuits, on the 30-volt generator and battery systems widely advertised and sold to suburban and rural purchasers.

D.—Ill-Advised Appliance Purchases by Householders.

1. Alternating current devices for use on direct current circuits, and vice versa.

2. Addition of appliances inherently dangerous, such as electric stoves not sufficiently raised from the supporting surface, portables incapable of connection to a cord without cutting away protective braid or even insulation, and like matters, and in general appliances not examined by Underwriters' Laboratories and listed as standard from both fire and life viewpoints.

E.—Inadequate Maintenance of Wiring and Appliances.

1. Wiring insulating coverings abraded and unrepaired cords with similar defects.

2. Broken bushings, sockets, snap switches, connectors.

3. Overloading and constant overfusing or bridging of fuses.

4. Removal of protective grounds of either conduit or circuit.

F.—Ignorant or Reckless Abuse or Misuse of Appliances.

1. Electric pressing irons, water heaters, etc., left turned on.

2. Knots in cords and cords over nails.

3. Placing cords through doorways or where subject to injury by feet or furniture, or over Christmas trees.

4. Placing lamps against combustibles.

5. Placing toy transformers or electric toys in the hands of uninstructed or unwatched small children.

The need for the avoidance of the above listed hazards is clear. The National Board of Fire Underwriters have collected statistics of over 30,000 fires from electrical appliances during the past year, many in homes. Most of these were quickly discovered and ex-

tinguished, but individual fire losses in homes from these causes ran as high as $350,000. The statistics of electrical accidents show scores of shock and burn fatalities annually in homes, and many non-fatal burns and other injuries; there are also many lives lost annually in fires of electrical origin; an economic waste running into the millions.

The means for avoidance of the hazards listed are not far to seek. It is rather a question whether we are prepared to make the new effort necessary to accomplish this end, and to make this effort along lines not laid down by our predecessors in the electrical inspection field, nor thus far tried by ourselves. We will first, however, inquire into suitable means of greatly reducing, if not actually eliminating, the foregoing hazards, and shall for brevity discuss these means in the order of the list.

A.

1. In new installations open knife switches are readily avoidable without material, and often without any, increase of original installation cost, by increasing the use of snap switches for small circuits, and of safety enclosed switches for larger circuits.

2. In new installations the unenclosed cutout can be obviated at low cost by the use of an enclosing cabinet. The cutout having live parts exposed during necessary handling of fuses can be obviated by use of one of the several "safety" types of fuse panels, and partly avoided by the use merely of panels having dead faces when fuses are in place. Best of all are the switch and fuse combinations enclosed in a cabinet of such construction that fuses become accessible only when they and all their accessible connections have been disconnected through the opening of the fuse chamber.

3. The installation of wire so as to have insulating covering exposed to disturbance is against the spirit of the National Electrical (Fire) Code and often against its letter. Attics that are at all accessible and basements call for concealment of wires or their isolation beyond chance contact.

4. The grounding of circuits should always be required to be to buried metal water piping if such is accessible, rather than to the far poorer artificial grounds too frequently permitted. No municipal water department or private water works is supported by any engineering or public interest considerations in a refusal to assist in this safeguarding of persons and property from a hazard for which the very presence of their pipes in houses is partly responsible.

B.

1. Where long cords, possibly tied in place, might otherwise be necessary, additional fixed wiring will usually avoid this, and in other cases reinforced cord can be used, as is also the case where abrasion is likely.

2. Brass shell sockets, metal fixtures and fixed motors can be made safe, no matter how near grounded surfaces, by assuring through protective grounding that their potential will be the same

as that of the grounded surfaces. Where grounding seems impracticable on the score of expense or appearance, the brass shell socket may either be placed out of reach, or may be replaced by a socket of insulating material. The metal fixture may also often be placed out of reach, to the advantage rather than detriment of the illumination. Fixed motors are generally of sufficient cost to warrant the moderate expense of connection to a good ground, but as stated in the National Electrical Safety Code, the connection will often be adequate if made to the nearest plumbing.

3. Portable motors, vibrators, pressing irons and chafing dishes all have inherent personal hazards, due to their portability, their necessary metal cases or frames, and their necessary attachment to fixed wiring through flexible cord. Some of these inherent hazards can be minimized through restriction of cord length, through restricting use of such devices to certain relatively safe places in the home, and through use of better and more suitable cords containing ground wire with the circuit wires, three wire connectors, of course, being also necessary. All these precautions are feasible at the present time.

4. Overloading of circuit wires may best be avoided by assuring against overfusing circuits. Use of sufficiently small fuses in household circuits is becoming, often, it must be said with regret, at the instance of service companies, a practice honored in the breach as much as in the observance. Greater use of special circuits is necessary in either new or old installations where there are portable devices of considerable current capacity, or several such are used or likely to be used on one circuit. Lighting fixtures and drop sockets are generally poor substitutes and unfortunately only too convenient ones for receptacles and feeding circuits of proper capacity.

C.

1. The use of 110-volt wiring for 30-volt service is not at all infrequent, and is increasing rapidly under the selling campaigns of manufacturers of 30-volt lighting systems. This, of course, constitutes a hazard implying no inspection service for the installation or a most ineffective one. It illustrates very clearly what is in fact the cure for all the bad practices we are outlining,—the extension of inspection to fields as yet untried and the simultaneous adoption of much more extended and more effective educational campaigns by inspection departments and other agencies.

D.

1. Purchases of devices proper in themselves, but unsuitable for the purpose intended by the householder, constitute a not infrequent cause of hazard. Salesmen not infrequently suggest unsafe uses for appliances to pleased and unsuspicious customers. Sometimes also devices, safe for one community, are transferred by the uninstructed householder to another community where he is taking up his residence and where the character of current or voltage so differs as to cause a hazard in use of the devices. The avoidance

of these hazards is rarely assisted by inspection departments, since in the house installations such devices are rarely even seen by the inspector.

2. The addition to the household equipment of the multitude of marketed appliances which are inherently hazardous also implies the absence or partial futility of inspection service. If a safe installation comes to mean safe so long as not used, but quite certainly unsafe when used, as it is surely going to be, then our inspection system is a delusion, and breeds a false sense of security for which we must as inspectors feel, if we do not assume, a serious responsibility. If ignorant, over-zealous or unscrupulous salesmen can, without any adequate restriction, and on an apparently increasing scale, continue to place in the homes of the unsuspecting public devices which meet no standards of safety, however moderate, we as the supposed protectors of the public's life and property might much better turn over our problem to other more capable agencies. We certainly must undertake well considered means to combat this evil tendency, and may in general rely on the public appreciation of such efforts to fully support them, even where some interests feel the pinch of restriction in output of their unsafe devices or reduction in the current supplied to them.

E. and F.

The character of use by the householder of his wiring and especially of his appliances varies from reasonably good to almost unbelievably bad. If the needed inspection assistance to the relatively ignorant and individually careless householder did not have so large a beam in its own eye, we should take more pleasure in pointing out the many motes in the eyes of the average householder of presumed intelligence and responsibility. It would at first seem impossible that so many electrical defects could be allowed or assisted by otherwise careful citizens to develop in an installation originally following safe standards and comparatively free from hazard. Evidently the householder needs instruction in simple terms, as well as does the salesman of electrical devices, the installer, and even our own individual inspectors. Who so well situated to serve the public interest in this regard as this and similar associations by planning campaigns of education, through which inspectors themselves may first get clearly in mind the necessary extension of their duties, and may thereby be enabled properly to carry out the necessary steps in informing or instructing others?

To suggest even briefly the form and direction which such a campaign must take to be truly effective is a task of some seriousness and large proportions. It needs and deserves your very earnest thought. The Bureau has been long alive to the need for educational work along these very lines. The National Electrical Safety Code, like the National Electrical (Fire) Code and other codes, is addressed to installers, and depends for its successful application on the familiarity gained with its provisions by trained men—inspectors, installers, manufacturers, and public utility men. All these

interests are organized and their activities are carried on in a more or less systematic manner. They can be depended upon to acquaint themselves with the necessarily detailed rules of the Code, and means to accelerate their acquaintance are being adopted. Your use of these rules in a more active manner is being recommended by your Standardization Committee as one of its suggestions for increased efficiency of the Association.

But the selling of electrical appliances, their selection by householders, and the use of the house wiring and appliances by the householder, all constitute unorganized activities, not yet under effective disinterested supervision. The degree to which these activities are brought under the influence of suitable standards will depend upon the adoption of suitable methods of supervision preceded and supplemented by educational methods. In this way some of the good effect which the Safety and Fire Codes are already exerting on electrical construction and operation, by trained persons, will be extended to the care of installations and to the nature of additions to them, by untrained persons. This problem is becoming an enormously greater one than even a few years ago, since the diversity of electrical uses in homes is so rapidly increasing.

The Bureau of Standards' publication along these lines, to be known as the Household Safety Circular, takes up the nature of electrical shocks and burns and the manner in which these hazards appear in the installation. The principal necessary precautions to be observed in the wiring installation and in the selection, maintenance and use of appliances are outlined in simple language, with excellent illustrations of certain dangerous practices. The Safety Circular concludes with a brief resume in rule form of precautions recommended for the observance of members of the household.

From this study made by the Bureau of these electrical hazards of the household we feel it advantageous at this time to offer the following concrete suggestions as to feasible steps in a proposed campaign to extend the usefulness of our existing inspection systems to electrical systems of the homes. In all this campaign when plans are complete for its initiation the Bureau of Standards and the National Fire Protection Association will gladly co-operate with your Association to the extent of their facilities.

1. Survey and list all selling concerns in your communities which handle electrical materials or appliances for home use. Include in this list all mail order houses, as far as practicable. Seek advice of your electrical contractors in preparing this list.

2. Issue bulletin to each selling concern, also to contractors, service utilities and general stores, urging the necessity where selling to household users to restrict their advertisements and sales as far as practicable to such material and appliances as have been examined and listed as satisfactory for such untrained users, by suitable disinterested examining agencies. Also suggest that they issue with such equipment as has inherent or readily developed hazards—pressing irons and vibrators, for example,—warnings as to proper location, character of use, and maintenance. To manufacturers of

30-volt devices a special bulletin might well be issued, dealing with the hazards of heavy current consuming devices on circuits having small conductors sufficient for 110-volt supply.

It might be well to state in such bulletins that the householders will also be advised to request and expect such co-operation on the part of selling concerns.

3. Issue to householders, through such agencies as may prove most effective—the service companies' monthly statements, the newspapers, circulars,—bulletins calling attention to the necessity for safety, of careful purchases of appliances, and of proper use and maintenance of both wiring and appliances. Urge their application to proper authorities in case of doubt, and make them realize that you and the other agencies are anxious to co-operate to assure that their electric service shall continue the safest form of utility for the home. Advise them of the availability of interesting and helpful literature on this and similar household safety matters, such as the Circular of the Bureau of Standards above referred to.

4. Finally, begin, through the aid of service utility inspectors or by other adequate means, a really adequate reinspection of the electrical installations and their appendages in all the homes of your community, asking to see the many appliances set away in cupboards as well as those actually attached. Such inspections, well organized and carried out, are welcomed, not resented, by the householder, and strikingly helpful results have been attained wherever these methods have been pursued. Co-operation of service companies will easily be obtained. Such inspections may readily be limited to a few matters, exposed live parts, arrangements for replacing fuses safely, improper fusing, over-fused circuits, lack of grounding of fixtures, misuse of overworn cords, bad practices in use of heaters and similar devices, possession of devices inherently dangerous. The service company co-operation will directly assist them in checking the maximum loads and in other ways, as well as assist the public by avoiding future dangers to customers.

The foregoing necessarily constitutes but a brief outline of the existing household electrical hazards, how they come to exist, what amount of danger they involve, and how they may be removed. The specific suggestions for action by inspectors are merely tentative. Your trained judgment as well as your widely varying personal experiences will enable you by co-ordinating your thought and efforts to evolve a truly suitable method of attacking and removing these hazards which we as inspectors in the public service cannot afford longer to ignore.

We hope that this matter will have your earnest consideration, by which both the National Fire Protection Association and the Bureau of Standards hope to greatly benefit, and by which your service to your respective communities can be greatly increased and in such a manner to give a much more widespread and helpful appreciation than usually exists at present of the character and extent of your services.

The Factory Watchman.

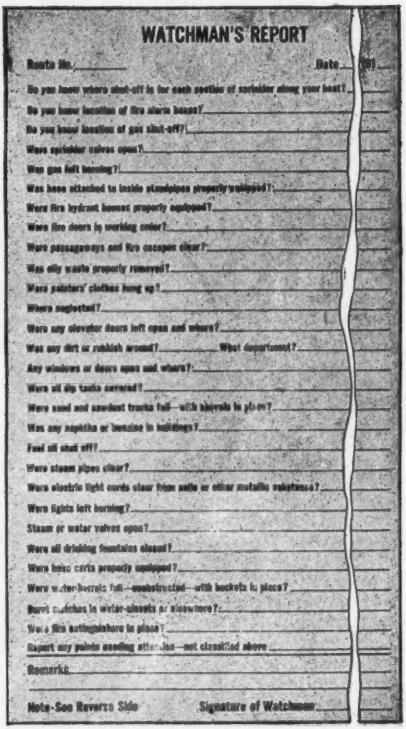
Our member, H. W. Troth, who has the responsibility for the fire safety of the great plant of the Victor Talking Machine Company at Camden, New Jersey, expressed himself rather positively in a recent letter to us on the subject of the duties of the factory watchman. Mr. Troth said:

> The tour of duty should be gone over by some one in authority and a decision made as to the length of time a man should take to make his rounds. His duty is not solely to go from box to box and ring up or register, but to carefully look into every possible place. Do not hurry him; if it takes you 25 minutes in the daytime to cover the route, allow the man forty minutes at night. As to the hours of the watchman at night, twelve and thirteen hours are inhuman; and, as every one knows, a man working at night is working against nature. It pays to arrange an eight or ten-hour shift. The writer's personal experience shows an eight-hour shift to bring the best results.
>
> The age of a night watchman should be considered. From 45 to 55 years of age is the best, as a man at that age is more reliable and wants to hold his position; he will be faithful and will give efficient service.
>
> The first duty of a watchman on discovery of a fire is to send in the city alarm and then fight the fire, not to fight the fire and let it get away from him and then send in the alarm when it is too late and the fire department is placed at a disadvantage by this delay.

The owners of all factories within call of an efficient fire department will agree with the last paragraph of Mr. Troth's letter. While men between the ages of 45 and 55 can hardly be called "old" as the world is today, certain factories make it a rule to employ younger men than these. It is essential in some plants that the watchmen be able-bodied and active young men to keep up with their duties. The International Harvester Company (Member N. F. P. A.) employs forty-two watchmen in the McCormick plant alone. We reproduce herewith from a recent page of *Factory* a fac-simile of the International Harvester Company's watchman's report. To be sure that the watchmen keep their eyes open when on the job, this report must be filled in completely each morning.

Reference to this report would indicate that a man must be quite wideawake to make all these inspections in addition to pulling the boxes. In some instances the watchman's rounds are on a half-hour service schedule.

Writing in a recent issue of the *Underwriters' Report*, Mr. W. H. Gibbons treats the subject of the watchman from the underwriters' viewpoint, with particular reference to shut-down or vacant properties, the undesirability of which as insurance risks he declares is as well recognized by the owners as by the insurance companies. So well settled is this fact that the problems of writing such risks



WATCHMAN'S REPORT

Route No._____ Date_____ 19[illegible]

Do you know where shut-off is for each section of sprinkler along your beat?

Do you know location of fire alarm boxes?

Do you know location of gas shut-off?

Were sprinkler valves open?

Was gas left burning?

Was hose attached to inside standpipes properly unkinked?

Were fire hydrant houses properly equipped?

Were fire doors in working order?

Were passageways and fire escapes clear?

Was oily waste properly removed?

Were painters' clothes hung up?

Where neglected?

Were any elevator doors left open and where?

Was any dirt or rubbish around? What department?

Any windows or doors open and where?

Were oil dip tanks covered?

Were sand and sawdust trucks full—with shovels in place?

Was any naphtha or benzine in buildings?

Feed oil shut off?

Were steam pipes clear?

Were electric light cords clear from nails or other metallic substances?

Were lights left burning?

Steam or water valves open?

Were all drinking fountains closed?

Were hose carts properly equipped?

Were water-barrels full—unobstructed—with buckets in place?

Barrel notches in water-sheets or elsewhere?

Were fire extinguishers in place?

Report any points needing attention—not classified above

Remarks

Note-See Reverse Side Signature of Watchman

WATCHMAN'S REPORT

Sprinkler System, Valves and Gages

Bldg. No.	Location	FIRST ROUND P. M.				LAST ROUND A. M.			
		Pressure air	Pressure water	Valve open or closed	Remarks	Pressure air	Pressure water	Valve open or closed	Remarks

REMARKS

19[illegible] Signature (Watchman)

Does your watchman simply pull his box while making his rounds? To satisfy themselves that the watchman really sees everything that is around him, the International Harvester Company requires him to fill out the above report and turn it in each morning as he goes off duty.

are for the owners to solve instead of the company, and owners are seen in such cases trying to make up policies acceptable to the companies rather than the companies trying to please the assured. There is, however, but one way for an assured to accomplish this, which is to provide some sort of substitute for the protection any operating plant gets from having employees constantly about. There is nothing to quite take the place of this protection, though theoretically an adequate watchman service should go a long way toward meeting requirements. Mr. Gibbons says:—

> Unfortunately, the frailties of human nature play too great a part in things of this sort, and in spite of fair promises by the assured in the watchman warranties in his insurance policies, the carrying out of the requirements in a satisfactory way will depend, first, upon how anxious he is to have his property cared for, and, second, upon whether he is fortunate in his choice of watchmen. The sincerity of an assured can in a measure be estimated, the values and possibilities of his property being something of an index, but a watchman must be taken somewhat on faith. His job is an irksome one at best and one that is rarely sought by any one who has the youth and ambition to do something better. He may be doing his best and his employer may have engaged him, with a full knowledge of his limitations, in order to secure a compliance with policy conditions as cheaply as possible.

In these circumstances the assured would have his watchman, whether "competent" or not being a question for a jury decision. At least there would be a watchman devoted to the service of watching the plant. Less than this would not be a compliance with the terms of the watchman clause in the policy. This was shown in a recent case in which the owners of a mill attempted to make use of the services of employees of an adjoining plant. Quoting from the decision:

> The mill was closed down and the defendant's agent informed the plaintiff that it would be necessary to obtain day and night watchmen. The plaintiff employed two watchmen, being the day and night foremen for a mill in operation, located from 600 to 1200 feet distant from the plaintiff's mill. It was agreed between the plaintiff and the foremen that they should attend to their duties as foremen, and, while on duty there, watch the idle plant of the plaintiff as their duties would permit.

One of these men went to the plaintiff's mill about four times a week and looked it over, while the other had never been in the plant, nor had he ever been provided with keys to it. The mill burned while it was idle and when there was no one about. The company naturally denied liability. Suit was brought, and in the lower court a jury rendered a verdict for the plaintiff, but the higher court took a different view, which was expressed in the following language:

> At the time the plaintiff employed these men plaintiff's officers knew the duties of the men in the other mill, and knew their opportunities for watching the plaintiff's mill and what time thereafter they gave to it. It is apparent that the plaintiff did not comply with the provisions of the policy that, whenever a plant is idle, competent watchmen shall be employed and due diligence used to keep a continuous watch both day and night in and immediately around said parts of the plant. Competent men were no doubt employed, but it was understood between them and the plaintiff that they were not to keep a continuous

watch both day and night in and immediately around the plant, but that they were to watch intermittently at a distance from the premises, estimated at from 600 to 1200 feet therefrom. The apparent object of the plaintiff was to evade its duties under the policy by making a show of compliance therewith. The diligence exercised was to evade and not to comply with the terms of the policy. We think the evidence shows that the men were competent watchmen and that, if they had been employed to keep a continuous watch in and immediately around the premises the property would not have been destroyed. But they were not so employed, and they did not so watch the property. The effect of the testimony of the officers of the plaintiff company was that the men were merely employed to keep an occasional watch from a distance, which they did, and which was opposite of the duties required by the defendant. This breach of duty voided the policy.

The action of the jury in the lower court in which this case was first tried is typical, and reflects the notion in the common mind that no one suffers in a fire loss except the insurance company insuring the property, whose vast financial resources and enormous profits make the paying of losses a delightful privilege whether the fire is preventable or not.

The Physical and Medical Requirements of a Fireman.

By Leo Steiner, M. D.,

Chief Medical and Physical Examiner, Civil Service Commission of Chicago.

I believe all will agree that 90 per cent of a man's ability to render efficient service as a fire fighter depends upon his physique and his physical condition. To be an efficient fireman, a man must possess not only ordinarily good health, but he must also be exceptionally strong in body, as it not infrequently happens that a fireman is called upon to perform strenuous labor continuously for many hours beyond the eight-hour period which is now being generally recognized as a day's work. He must respond on a second's notice to a call in weather fair or otherwise, to protect the lives and property of his fellow citizens. He must be capable of withstanding the most violent physical exertion. His muscles must be hard, his respiration good, and his power of resistance great. If he is not in possession of these qualities, he will be unable to execute the commands of his superior officers. He may be ordered to enter a burning building containing smoke or noxious gases, and while in that building he must labor with sustained effort with hose, axe or pikepole. Here is where his lung capacity will be brought into play. Here is where he must call on all his reserve physical force. Here is where he must call on all his muscles to perform rapid work. The amount of work he can do in the briefest period of time depends on his physical condition. Here is no place for small effort or weakness, because life and property depend upon his physical condition. Hence the importance of his medical and physical perfection. In order that the fire service of a city may be composed only of those men who are able to measure up to the hard tasks which the danger and nature of the work involve, a rigid medical and physical condition must be exacted. Of course, the determination of the fitness of a candidate for the fire service is not left to guesswork. He must conform to a medical and physical standard before entering the service.

The general routine in Chicago is as follows: Age, between the ages of 21 and 30; height, minimum, 5 feet 8 inches; weight, minimum, 150 pounds, maximum, 190 pounds; chest, must measure 35 quiescent and expand 3 inches. For heights over 5 feet 8 inches, minimum and maximum weights and chest measurements must conform to a schedule. After a candidate is measured and weighed, if he is not rejected, he is turned over to the medical examiners. He is then given a searching scrutiny for medical and physical defects involving every portion of his

body. The discovery of any defect results in his rejection. He must be able to read at a distance of twenty feet a chart or test card, without the use of glasses, each eye being tested separately. His color vision must be perfect; that is, he must be able to recognize and name the cardinal colors promptly. If he passes the vision test, he is then examined as to the condition of his heart, lungs and all organs of respiration. His hearing is subjected to a watch test to ascertain if same is normal. His brain and nervous system must be normal beyond the question of a doubt. Any evidence or history of disease of the brain or spinal cord is sufficient at least to hold his case under advisement for further examination. He must be free from physical defects; that is, he must have the use of his arms, legs, hands, feet, fingers, etc. He must also be free of hernia, hemorrhoids and varicose veins, and not show evidence of any infectious or contagious disease. There must be evidence of recent vaccination, and his teeth must be in good condition. A urinalysis test must indicate the absence of sugar or albumen.

Physical Ability Tests.

After the applicant has successfully passed the medical examination he is subjected to a series of tests to determine his physical ability. The first test is given to ascertain the cubic capacity of his lungs. This is accomplished by means of an apparatus called a lung tester. The applicant blows through a rubber tube into a tank which registers the cubic capacity of his lungs. He is then tested as to the strength of his forearm, which is determined by an appurtenance commonly called a grip machine. Next is used an apparatus for testing the strength of the pectoral muscles of the chest and of the traction muscles of the back. His bicep muscles are given a chinning test, also a hand-over-hand test on a horizontal ladder. He must also climb a rope hand over hand, across, back and down, which is quite a severe test. The strength of the adductor muscles of his legs are ascertained through the use of a contrivance for that purpose. His agility is tested by a running jump over a rope four feet high.

Fire Service a Good Training School.

In this connection I might state that the men who compete in promotion examinations, while older, outrank in physical prowess those who take the original entrance examinations. This applies even to men who are competitors in the examinations for captain and assistant chief. This would prove that the fire service is a good training school for those who wish to remain in perfect physical condition, irrespective of rank. Usually our fire stations in Chicago have a hand-ball court, where the men are afforded an opportunity for exercise.

The Toy Transformer and its Hazards.

Chester H. Thordarson in *Electrical Review*.

Electrical transformers for stepping down 110 volts alternating current of the usual lighting circuit to much lower potential for operating electrical toys have become an established commodity in this country. The rapid increase in the sale and distribution of these transformers in the past few years has been due, to some extent, to increase of battery cost, but chiefly to the wider distribution of alternating current electricity supply to homes.

Although a number of short articles have been written by different manufacturers, wherein each has explained the merit of his design, it is curious to note that a general article on this subject for the benefit both of manufacturers and the public is hard to find. With my very extensive experience in toy-transformer designs, having been one of the very first to introduce one on the market, I feel in a position to give some advice beneficial alike to the manufacturer and the public at large.

Seal Transformers to Protect 110-Volt Circuit.

It may be said that small electrical devices used on a few volts may have no limitations as to cheapness. But it is quite otherwise with the toy transformer that is connected to the 110-volt circuit. There safety must always be paramount and, therefore, such transformers must be very carefully designed. It is of the utmost importance that toy transformers be made as foolproof as possible. Therefore, ordinary screws are most undesirable, as they incite the boy's instinct for dismantling. The 110-volt circuit should be made as inaccessible as possible and, consequently, the transformer case, whether of wood, slate, porcelain or metal, should be so assembled that the boy cannot take it apart without breaking or destroying it.

This is also greatly to the advantage of the dealer, for, in case of trouble, there will be less cause for dispute if the transformer has not been opened.

Desirability of Using Sealing Compound.

The advisability of using insulating compound for sealing the transformer in the case deserves serious consideration. While the use of compound is largely dependent on the size and shape of case, it has several advantages, such as protection of coils from nails and knife blades. The objections advanced against compounds, because of the liability of flowing out of the case when hot, bear little weight since cases can be made to hold liquid compound. It is a fact that

compound-insulated coils stand up two to four times longer under short-circuit conditions. This is in spite of the fact that insulating compounds are good heat insulators. The reason is that the short-circuited coil soon melts the surrounding compound and this liquid conveys away the heat. This liquefied compound now penetrates between the layers and turns of the winding and when cooled, provided the short-circuit has not been extended, the winding will show a higher insulation test than before.

There is also less danger of fire when compound is used. A short-circuited transformer can easily ignite its paper and fiber insulations, and the fire in turn can spread rapidly to the heated carpet or floor, especially if its bottom be open. The advantages of using compound in toy transformers are, therefore: first, better protection of the 110-volt winding; second, transformer will stand short-circuit for a longer period; third, fire hazard is greatly reduced.

Precautions Regarding the Regulating Switch.

With the great variety of low voltages required for different motors and lamps, the regulating switch has become an established practice. A few manufacturers, however, do not use this switch, but have standardized a one-voltage unit to take care of their different types of motors. However, the transformer built for general service is more flexible if equipped with a regulating switch. Such a switch should always be placed on the top of the case so that the various voltages may be easily observed. A switch placed on the side, while a cheaper and simpler manufacturing proposition, has one disadvantage in that the boy in adjusting and reading is apt to tilt the transformer, which in turn bends the lamp cord at that point where it enters the transformer case. This repeated bending at this point greatly shortens the cord's life. This is a most important point, as the most serious consideration in the operation of the toy transformer is the proper care and attention to the 110-volt cord.

The present practice of using a wide variety of low potentials for operating toys and lamps from transformers is very annoying and expensive to the public, and in this practice we hope there will be a great change in the near future.

The toy manufacturers of the United States of America, just organized this year, will undoubtedly render a most useful service to the toy manufacturers, dealers, and the public at large by establishing standards most suitable for the low-potential devices. Such standardization has hitherto been impossible, but, when established, will create simpler and better toys with greater satisfaction to the user.

Special Protective Devices.

A number of toy-transformer protective devices have been devised to guard against short-circuit troubles, such as warning by means of lamp, bell or buzzer. The need of such protection is readily

realized, as the train tracks so commonly used oftentimes short-circuit the transformer. Positive circuit-openers seem to be more desirable.

The use of the fuse on the secondary circuit is a very good one and has been successfully tried. As the primary circuit should be in every way inaccessible, the fuse cannot be used on this winding. The most serious objection to the use of the fuse is that the boy will consider he has made a wonderful discovery when he has substituted a strip of metal, nail, or wire, and finds that operation is as satisfactory to him as with a fuse that is continually melting. The manufacturers of transformers with fuses should furnish explicit instructions with each transformer to use the proper fuses, preferably those furnished by the transformer manufacturer.

Undoubtedly the best protective device is the electromagnetic circuit-breaker placed in the primary circuit and mechanically restored by means of a push button and having its circuit entirely inaccessible. Such a circuit-breaker, unfortunately, cannot be built cheaply, but will undoubtedly be extensively used in the future on the best and most expensive toy transformers.

Danger of Using Binding Posts on 110-Volt Circuit.

We cannot pass over the design of the toy transformers without warning against the danger of using binding posts on the 110-volt circuit. When 110-volt binding posts or other mechanical means are used whereby a boy can readily detach a 110-volt cord from the transformer, there is a great liability of danger, as the boy or child is not apt to make a good connection in fastening the cord to the binding posts. There is a special danger of the cord becoming loose, which is most apt to happen if a child lifts the transformer or moves it about when the current is flowing through it. In such a case the wires can separate and cross, and if the hand is near the binding posts it may be seriously burned. We have too many cases of special heavy fuses being used that allow an excessive rush of current from the line in the case of a short-circuit.

Liability of Connecting 110-Volt Supply to Low-Voltage Side of Transformer.

Nor does the greatest danger lie in the short-circuit and burning from same, but rather in the liability of a boy connecting the 110-volt cord to the low-voltage side of the transformer. In such a case the transformer becomes a step-up transformer delivering a potential that can be fatal to anyone touching the secondary circuit when the current is thrown on.

To convince myself what really would happen if a transformer is so connected, I had a small toy transformer, that had been rated at less than 50 watts, tested by one of the largest and best equipped electrical testing laboratories in America. The tests were made with a General Electric oscillagraph, showing the shape of the secondary voltage and current wave on this transformer. The highest potential of this transformer on the low-voltage side was in the neigh-

borhood of 25 volts. Across the high-voltage side a non-inductive resistance was connected corresponding in resistance to the body of a full-grown person.

It was found that on throwing 110 volts on the low-potential side, the high voltage measured 596 volts with one-eighth ampere flowing through that resistance. The lowest secondary voltage of this transformer was about three volts. When 110 volts was switched on this circuit a corresponding resistance was connected across the high-voltage side, which then delivered a potential of 1,140 volts with a current of one-third ampere. The oscillagraph showed a surge voltage superimposed on this voltage that indicated 2,070 volts.

Now, we can easily conceive that children playing with a toy transformer having binding posts or other mechanical methods for connecting the 110-volt cord are extremely liable to this danger. Suppose a child is playing with a track that is connected to the high-voltage side and has its hands across the track. A boy who would then connect the plug or switch on the 110-volt circuit would thereby allow a secondary voltage in the transformer to be produced that would not be less than 590 volts (which is about the highest street-railway potential) and which could be anywhere up to 2,000 volts. Now, as we know that the electrical resistance of the body of a child is very much lower than that of a full-grown person, it is plain that the current that a child would get in this case would be very much greater than these tests have shown. A report of this test can be furnished to anyone sufficiently interested.

With all my experience in designing transformers for extremely varied work, I have never allowed a toy transformer to leave our factory with binding posts or separable connections on the 110-volt side.

General Features of Design.

I have omitted any discussion of the design of the electric and magnetic circuit of the toy transformer, as the best proportions for iron and copper losses, resistance and reactance are easily obtainable by every manufacturer to suit his best conditions. Also the shape and color of the case I think unnecessary to discuss. However, this may be said, a toy should always approach as closely as possible that which it is supposed to imitate. Therefore, there may be some argument in favor of a design of transformer that resembles most the real power transformers. However, such a condition is oftentimes expensive and hard to realize.

This article is an appeal for good design and especially for safe construction of the toy transformer, for such a transformer, well constructed, is safer than the ordinary pocket knife, and there is no toy that can give better entertainment and instruction to children and grown people all the year around. Toy transformers have come to stay, and they will all be made safe and will become a very important factor in home entertainment and instruction.

Hollow Tile as a Factor in Fire Prevention

By Walter A. Hull.

(Member N. F. P. A.)

The development of the American skyscraper ushered in the era of fire-resistive construction. Steel frame construction did away with the existing limits to the height of buildings, solving some of the building problems of the times and creating new ones. The new heights, in themselves, introduced difficulties not hitherto thought of: there was a limit above which firemen could not fight fires effectively with hose streams, danger to human occupants was alarmingly increased and the tremendous investments in these monstrous buildings were seen to be undesirable risks from the insurance standpoint. There was one logical, inevitable answer to these difficulties: if buildings were to be built many stories higher than the old brick and timber structures, combustible material must enter as little as possible into their construction.

The old standby as a non-burnable building material was burned clay in the form of brick. Nothing better being available, brick was used, for walls, partitions and even for floor arches, in some of the early skeleton construction buildings. Of course, the objection to the extensive use of brick in this way was the excessive dead load that had to be provided for in the steel work of the building. The obvious remedy was to make burned clay building units hollow instead of solid. There were, at that time, sewer pipe factories that made some hollow building blocks for foundation walls of dwellings and other small buildings. It was but a short step from these blocks to the partition tile and the first hollow floor arch blocks of burned clay.

Without the skyscraper, the development of the hollow tile industry would have been slow and insignificant; without burned clay hollow tile, the earlier growth of the skeleton construction building would unquestionably have been greatly retarded. The development of these two giants, the skyscraper and the hollow tile industry, has wielded an influence in the progress of our attainments in fire-resistive construction which can hardly be over-estimated. The tall building, introducing, as it did, new hazards and new problems in building to prevent as well as to withstand fire, stimulated activity in the direction of better design. The necessity brought forth vigorous and effective endeavor. Hollow tile contributed, to a most important extent, to the new order of things, not only by making the relatively quick success of the tall building possible, but also by

Hollow tile in steel frame construction showing column and girder coverings and floor arches.

providing an effective medium, at moderate cost, for fire-resistive construction in other types of buildings as well.

The early days of the skyscraper were trying times for hollow tile. Buildings of the new type were scattered here and there among older, burnable buildings, and the exposures were severe in the extreme. The aggregate amount of interior fuel in the form of floors, doors, trim, etc., was enormous. Unprotected window and door openings were the rule, and in those fires which reached the proportions of conflagrations, everything combustible both within and without the so-called fireproof buildings was consumed. Those were terrific tests. The saying became current that "fireproof buildings were not fireproof"; yet to the fair-minded observer the marvel was not so much that these buildings were damaged in such conflagration conditions as that they survived at all. Instead of condemning them, the building profession set about to eliminate the weak points of the earlier forms of construction and to better safeguard against hazards within as well as exposures without. Shutters, wired glass windows, enclosure of vertical openings and the dividing of large floor areas, together with the introduction of sprinklers and the elimination of most of the combustible structural features, gave better protection to buildings and contents. In much of this improvement hollow tile played an important part, for the very availability of hollow tile for the purpose encouraged the extensive introduction

High class country residence showing stucco over hollow tile.

of such forms of protection as partitions and stairway and elevator enclosures, which are of the utmost importance in safeguarding both property and human lives. The effectiveness of adequate fire stops, consistently arranged, has come to be realized in very recent years as never before. The universal adoption of adequate systems of fire stops in large buildings would mean the passing, for all time, of the large, high value fire. Confined to small space, no fire, except in explosives, can get beyond control, whereas, as has been demonstrated time and again, and in most costly fashion, the fire which finds no effective structural barriers in its path is only too likely to become a raging, racing monster which no human agency can hope to cope with. All those materials and forms of construction which lend themselves effectively and economically to service as fire barriers deserve recognition as important factors in the elimination of fire waste, but it must be remembered that in the earlier development of extensive fire-stop systems, hollow tile was the pioneer and that without this structural medium the progress of fire control must have been seriously retarded.

Fire-resistive construction, beginning with the skyscraper, was extended over a wider field, including factory buildings, warehouses and apartment houses. The importance of the part played in this progress by hollow tile may be gauged from the following extracts from a report, made as late as 1903, by Rudolph P. Miller, then Engineer of the Bureau of Buildings of the City of New York:

"Nine tests were made to compare the fire-resisting quality of different materials with that of a 2-inch terra cotta block. . . . The Superintendent of Buildings has the power to define what constitutes fireproof material. Terra cotta has been accepted as such ever since the introduction of fireproof construction, and therefore was accepted in these tests as a basis of comparison."

Yet it is not only in the cities that terra cotta has gained recognition as the standard fire-resistive material; one of the significant features of the increase of wealth and the growth of better standards of living in this country is the development of the modern country house. High class dwellings, remote from city fire departments, make special demands on structural materials. These buildings are not temporary affairs, to be torn down, after a few decades, to make room for the advancement of a growing city. On the contrary, the conditions are here favorable to the erection of buildings that will endure, without depreciation, for many generations. In such dwellings it is worth while to provide exterior walls that will be proof against dampness and will effectually keep out the cold blasts of winter and the excessive heat of summer. In order to endure for long and to justify the substantial investment which such a house must represent, it must be as safe as possible against fire. Finally, it must be architecturally beautiful. Here again hollow tile supplies the needed material to fulfill the requirements, contributing in no small way to this phase of our national development.

But it is not alone in the homes of the wealthy that this material contributes to our rural improvement. The practical farmer purchases hollow tile for the construction of his silo and the sanitary dairy barn. Appreciating the importance of permanence, of fire safety, and of the comfort and health of his live stock, he builds in the same substantial, but economical manner, his other farm buildings, including the humble pig pen and the poultry house. So adaptable is this building medium, and so capable of specialization, that farmers are now using well ventilated rat and mouse-proof terra cotta corn cribs for the storage of the corn crop.

Another field of usefulness, and one which bids fair to develop large proportions in the next few years, is that of the individual dwelling of moderate and even of low cost. Year by year the appreciation of permanence and of low maintenance expense is increasing, and the difference in cost between burnable and non-burnable construction is narrowing down, so that it is gradually coming to be recognized that the wall of hollow tile is a good investment, even if faced with brick, and its use in dwellings is steadily coming into favor, in spite of the slowness with which building regulations and insurance ratings adjust to changing conditions. Perhaps a new impetus will be given to this tendency, which is highly desirable from the fire protection standpoint, by the introduction of presentable facing tiles. The old hollow tile wall had to be covered up with something else to make it presentable. Brick facing is expensive, and, while stucco is more economical, not every one wants a stucco house, and it is not desirable from an artistic standpoint that this

Wholesale use of facing tile in an economical type of dwelling house construction.

medium, beautiful as it is when properly handled architecturally, should be given such a monopoly as to monotonize our landscapes. Rather tardily, it seems, but perhaps as soon as building conditions would justify it, the tile manufacturer has now brought forth what seems the obvious thing, in the shape of facing blocks of hollow tile. In point of color and texture there is no difference, and no reason why there should be any difference, between the effects producible in clay tiles and those that are so well known and so much admired, in clay bricks. The material and the process of manufacture are similar. In the matter of size, the tile unit is different from the brick unit because a larger size is more economical and convenient for hollow tile manufacture and erection. How well this new departure is going to appeal to the architect and to the more or less discerning building public remains to be seen. We are used to the brick house, in which the facing unit presents to the eye a surface about eight inches long and two and a half inches wide. The tile house, with the facing unit twelve inches by five, will present a new and, of course, in the beginning, a strange appearance; yet there seems to be no reason to believe that such a unit will not lend itself, in the hands of the architect, to the production of pleasing effects in his general scheme, as well as the smaller unit. Bricks have been made about eight by two and a half, some of them twelve by two and a half inches, or a little thicker, since the beginning of civilization, or thereabouts, simply because such sizes were prac-

tical, convenient, economical sizes in which to make bricks. The architect takes them as he finds them and accomplishes much with them. Influenced by other features which he can obtain only in hollow tile, he will undoubtedly take up this new medium, possibly with some hesitation, and obtain from it architectural beauty which may be as gratifying, or possibly even more satisfactory, than those he has been producing with the other mediums at his hand. Should this be the case, the opportunity for hollow tile to render service in the dwelling house field will be broadened, and we may expect this building medium to meet the needs here as it has already done in other types of fire-resistive buildings.

Considering the breadth of the field covered by hollow tile and the decades of service that it has rendered, it is rather remarkable how little is definitely known about those fundamental physical qualities which determine its usefulness and particularly its fire-resistive properties. In very recent years there has been some activity along the line of determining the strength of tile blocks and of tile walls, and the results of these tests are gratifying in that they indicate that this class of material has structural possibilities that are capable of further development. On some of the important features of its fire-resistive qualities very little definite information is available. Although it has been performing faithful service in fire protection for decades, this material is subject to criticism because of those cases in which hollow tile partitions and other parts of buildings subjected to severe fire, or fire and water treatment, have been damaged, more or less seriously, entailing the necessity of subsequent repairs. It may be that the extent of such damages and the importance of this tendency have been exaggerated. It is natural that this should be the case for the reason that every injury to hollow tile is plainly visible. Either it is injured or it is not, and, if it is, the damage is always exposed where it will show. Furthermore, a rather unimportant damage, structurally, may show up so obviously and spectacularly as to leave a lasting impression on those who walk through the burned building, making casual observations rather than a technical study. While this may work to the disadvantage of hollow tile in the effect on the mind of the building public, there is, after all, a good side to this very obviousness, for it may be said, in fairness to hollow tile, that it is more honest than some materials because it does not sustain injury by fire without showing the extent of that injury. In appraisal, or in repair, there is very little room for doubt in the case of hollow tile.

Unfortunately, no building material that has so far come into use is indestructible or immune to injury from fire and water, and when the backers of one material point to the weakness of another, it is a case of the pot calling the kettle black. One material may be better than another for certain purposes and in certain respects, but there is no one material superior to all others for all purposes nor in every respect. We find many things in favor of hollow tile. We find one thing against it, in its tendency to crack, so that the outer web will break off, in some cases of exposure to fire, or fire

and water. Such troubles may be expected to decrease with the improvement in our fire prevention construction, for the high pressure hose stream, in particular, is gradually being eliminated from the fire protection scheme, so far as high class buildings are concerned. However, it is not the right attitude to assume that even moderate losses from this cause are inevitable. We Americans are not fatalists. Neither is it right for the friends of hollow tile to assume an attitude of complacency because of the fact that no other material is free from weak points. We are coming to realize, as never before, that we cannot afford preventable losses. Hollow tile is in extensive use, and it is going to continue in extensive use. Is it not a matter of importance to have an answer to the one simple question: Are the fire losses due to the breaking of hollow tile preventable? It is safe to say that no answer will be immediately forthcoming. There is no answer in our literature and none to be deduced from the information to be gleaned therefrom. The published accounts of fires may be either distorted, according to the zeal of the writer, for or against the material, or descriptions may not be sufficiently definite or complete to convey the essential facts from which to draw conclusions. The reports of the limited number of fire tests that have been made are insufficient, and it seems evident that further investigation along this line is both necessary and promising.

We know that clay is not a definite mineral and that the various clays and shales from which hollow tile is made, in various districts, and even in the same district, differ rather widely from each other in their physical characteristics. The burned products from some clays are more easily cracked by quick heating than those from other clays, and the same is true, to some extent, of different products from the same clay. It has been found that, with some materials, even a very slight difference in the process of manufacture may make a surprisingly great difference in the nature of the product in this respect. It has been a matter of frequent observation that porous hollow tiles are less subject to fire damage than dense ones, and while there are objections to the very extensive use of porous terra cotta, these observations indicate that we may expect to find other controllable qualities that affect the behavior of terra cotta under fire. These considerations lead to the belief that investigation would show that the product of some factories has less tendency to break under fire than that of others, and that in the case of a factory whose product was found to be objectionable on account of a pronounced tendency toward cracking, improvement might possibly be made if it were systematically undertaken. As matters stand now, we have no satisfactory standards by which to measure or judge the fire-resistive qualities of hollow tile. The individual manufacturer has no way of knowing what is expected, or what ought to be expected, of his product in this respect, and he cannot, perhaps, be blamed for any seeming indifference about meeting standards which do not exist. The individual architect or engineer finds no standards on which to base his specifications, and so he disposes of the matter by writing into his specifications some such perfunctory

requirement as "good, hard burned terra cotta." The contractor is satisfied so long as the goods are delivered on time and are of such character as to permit of their being placed in the building at minimum cost; but the insurance rate which the owner pays when he insures his building includes, we are led to believe, a factor of safety, or of uncertainty, which is in some way related to the fact that some tiles, in some buildings, have been known to break under fire. It may be unwise for the layman to try to find reasons in the fathomless depths of insurance ratings, but if the writer were to suggest a reason for the fact that more credit is not given for hollow tile than is given, it would be that somewhere, back in the subconscious part of the insurance mind, there is the instinct, or the feeling, that here is an indefinite sort of a hazard which may at some time develop into a definite sort of loss. Back in the subconscious fireproofing mind there may be the feeling that here is a class of material which is superior and has been superior for decades and which has, as a class, or in general, certain inalienable rights, including that of credit without test. While the insurance mind feels that before a material shall have additional credit it should have approval, based on acceptance tests and other requirements, it may be that the fireproofing mind feels that the acceptance test is an artificial sort of thing which does not represent a practical standard. Perhaps a limited amount of systematic investigation, planned and carried out with the one object of eliminating preventable losses in hollow tile, would lead to the adoption of standards that would be acceptable to all interests and would result in an economic saving that would affect, as all large economic savings do, the purchasing public in general. Some suggestions have already been made as to the possible trend of such an investigation. It should be said, in addition, that such an investigation should include a careful determination as to the possibilities of various plasters as protection for hollow tile. Theoretical considerations, as well as the testimony of numerous observers, indicate that the damage to a tile wall is usually due to the quick heating, or quick cooling, or both, of the side exposed to the fire. Plaster has been found to be a moderately good heat insulator, and since the exposed side of structural tile is usually plastered, it seems important to know how much benefit can be derived from the plaster in resistance to this quick heating and cooling. Undoubtedly much depends on the ability of the plaster to stay in place, and therefore if one sort of plaster can be depended on to stay on better than any other, that ought to be known, and generally known; also, if the ability of the plaster to stay in place depends in any large measure on the nature of the corrugations in the surface of the tile which give the plaster a grip on the tile, that ought also to be known, so that this as well as every other practical means could be used for the prevention of economic loss.

At the beginning of our participation in a war in which our industrial strength seems likely to be taxed to the utmost, it may seem visionary to dwell on any thought of new investigations of this scope. On the other hand, it does seem worth while that those who

are interested in fire-resistive construction, and especially those who are particularly interested in hollow tile, should have these things in mind, so that such information as can be obtained, from time to time, from various sources, may be recorded in such form as to be available for correlation. Hollow tile is rendering a service of great importance over an exceedingly broad field, and all information is of importance if it is put into such form as to assist in cutting down preventable losses and in making it possible for hollow tile to outdo in the future its services in the past.

Open-Sprinkler Efficiency.

The Solution of a Problem at Atlantic City.

By A. T. Bell.
(Member N. F. P. A.)

Some years ago The Leeds Company, which operates the Hotel Chalfonte in Atlantic City, purchased three small adjoining hotels, Cedarcroft, Warwick and Rydal, for the purpose of safeguarding its principal buildings from several different viewpoints. These properties were of frame construction, and under certain ownerships might be very hazardous as moral and fire risks. After owning them for some years, the company decided to protect these properties more fully from fire in order that they might not serve as a means of passing a possible conflagration from exposing structures to the main buildings of the hotel.

Cedarcroft contains 70 bedrooms and is the home of about 140 women employees. It was first sprinklered inside. Two years later it was decided to protect the outside with open sprinklers. It was recommended that a line of heads be placed at the top of the third floor windows and another at the top of the building, which is five stories high. The schedule rating expert was not satisfied with this plan and desired a head over every window. The amount of water required for either plan was so great that it seemed to be prohibitive in view of the probable scarcity of water at the time of a conflagration, when the protection would be most needed.

A tower having no economic utility and small ornamental value was removed to reduce the hazard. Certain members of it were set up conveniently on the ground. Experiments were made on them with various arrangements of heads and other devices. It was found that—as is the case with all properly built frame buildings—the water was *thrown off* the building at many points. Economical and effective use of the water for a curtain requires that it should be *kept on* at every point and produce a continuous film of water from top to bottom.

After reaching some definite conclusions as to how to do this, a few heads were set up on the building as it was. Tests showed

that probably 70% of the water dropped clear of the building and did very little good. Thirty per cent "worked" very effectively. The 70% of water simply passed through the air instead of going on to the building and cooling the wood and glass.

The woodwork under the test heads was then remodeled so that it would throw the drops of water *on* instead of *off*. An "in and down" slope of wood under the cornice came first. Then two places in each cornice bracket that had shed water were filled in so that they held it. The lowest row of shingles on the flaring belt course was rounded carefully to coax the water back to the clapboards. "In-slopes" under the window sills did the same there. When experimenting was finished it appeared as if 70% of the water had stayed *on* instead of 70% going *off*.

After this all the faces of the building were changed to conform to the above description. The outside sprinkler installation was then made by putting heads at the cornice only, which is the very topmost wooden point. No heads were put lower than this except, of course, to protect the walls under several porch roofs.

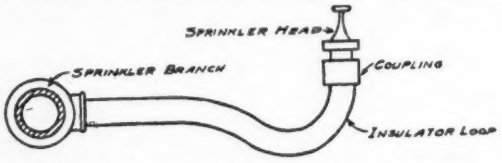
The result has been very satisfactory in tests. One wall about 53 feet high by about 78 feet long which has no porches is protected by 17 heads with ⅜-inch outlets at the cornice. At a recent demonstration the City pressure of 35 pounds covered the wall completely from top to bottom within 30 seconds from opening the valve. This light water film was undoubtedly ample for perfect protection. At 150 pounds the water curtain was tremendous, and not only completely covered every square inch of wood and glass with a heavy sheet of water, but poured down the side in a torrent.

Heating Buildings with Sprinkler Systems.

By E. D. Densmore*

The fact that the installation of a system of automatic sprinklers is becoming more general in modern commercial and industrial buildings has led to the development of the sprinkler system for heating purposes.

As is well known, the sprinkler system consists in general of a series of pipes which cover uniformly the ceilings of all floors. If the water which is maintained in the sprinkler system could be



Bend Required to Protect Sprinkler Head from Hot Water Action.

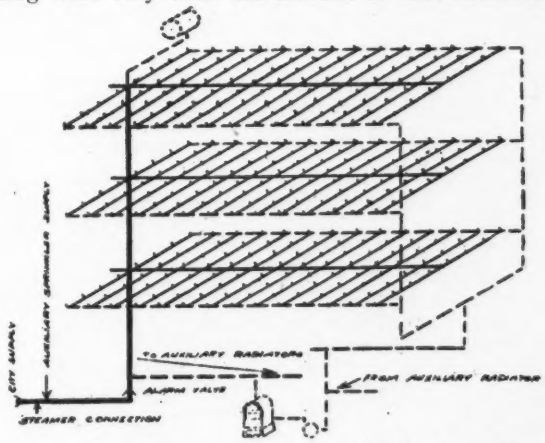
* From a paper before Convention of the National District Heating Association.

heated and circulated, of course the sprinkler piping could be used for heating. One fundamental objection would be that the sprinkler head which is in ordinary use would melt at the temperature necessary for the water if it were to be used for heating purposes. This melting of the sprinkler head is prevented by means of a U connection through which the hot water cannot circulate. It has been found in practice that such a device will prevent the head from melting. A sketch of this insulator or U connection is shown herewith.

In order to make sure that all the sprinkler piping will be an efficient heating surface, it is necessary to connect up the sprinkler mains and runouts so that circulation takes place through all the pipes, as shown in the accompanying diagram.

The connections of the hot-water heating system with the sprinkler piping are exceedingly simple and need not change the sprinkler piping in any way. The hot water heater may be located in any convenient place, either in the building to be heated or in an adjoining building. From the hot-water heater a hot-water supply pipe is run and connected to the foot of the sprinkler riser inside the sprinkler alarm valve. It is advisable to install an ordinary stop valve at this point, so that the hot-water supply may be entirely shut off from the sprinklers when necessary. Between the hot-water connection to the riser and the sprinkler heads no changes are made, the sprinkler riser, laterals and distributing pipes being installed in the usual way.

The amount of heat which is required in any building is, of course, proportional to the exposed glass and wall surface, so that if a building were very narrow and the exposure proportionately large, the amount of heat obtained from the sprinkler system would perhaps not be sufficient to heat the building. On the other hand, if a building were very wide the amount of heat obtained by circu-



Broken Lines Show Piping Necessary to Utilize a Sprinkler System for Heating Purposes.

lating the water in the sprinkler system might be adequate for heating.

In practice it is found that when the conditions in a building are such that circulating the water in the sprinkler system will give adequate heat, the cost of the combined system is less than the cost of a separate sprinkler system and a separate heating system. If the sprinkler system does not give sufficient heat it is necessary to add radiators or coils. This complicates the scheme somewhat, but, of course, up to a certain point additional surface can be installed and still have the combination scheme cheaper.

The general arrangement of the system is such that the water in the sprinkler system is circulated upward through the building and back through the heater. This circulation will take place by gravity when conditions are favorable or it can be forced by a pump. Whatever pressure is on the sprinkler system will, of course, be on the heating system.

It is necessary to arrange for the expansion of the water. If the building is on a tank this expansion could be taken care of through the tank. The ordinary sprinkler system has check valves on both the tank supply and on the street supply so that some special scheme for expansion is usually necessary. Sometimes a pressure expansion tank is installed or else by-pass connections are placed around the check valve. If cast-iron radiators are to be used, it is to be borne in mind that in high buildings the static pressure on the lower floors is considerable.

The advantages claimed for this combination system are simplicity and first cost. These claims would be justified where the sprinkler system would supply the larger part of the heat necessary. It is also claimed that the sprinkler pipes, having water circulating all the time, are less liable to become clogged up. It is also claimed that a uniform distribution of heat is obtained. This is true, but, of course, it is also true that the heating surface is all on the ceiling, which in some cases would not be desirable, particularly where heat is required under windows to prevent drafts.

In general the objections to such a system are that it is undesirable to mix up the fire protection system with anything else. The inspection and maintenance of the fire protection system is of great importance, and it is a grave question whether or not it is wise to combine this system with the heating system from the point of view of fire protection. The necessity of having the sprinkler heads connected with the U connections makes it possible for sediment to collect in these U connections since no circulation takes place through this pipe.

In general it may be said that this system offers an opportunity for a wide range of usefulness, and it might be expected that as time goes on the field which it will occupy will broaden. Many successful installations have been made, and apparently no fundamental difficulties have been encountered over a period of several years in operation.

Electrical Station Fire Prevention.

From *Safety Bulletin*, Bureau of Safety, Chicago, Ill.

It is recognized that the fire hazards of the electrical industry have been greatly reduced in the last two decades. Old methods of construction wherein more or less wood and other combustibles entered into structure of buildings, switchboards and other electrical equipment have fallen by the wayside in the marvelous advancement of electrical development. Along with this advancement has come a high degree of efficient housekeeping. "A place for everything and everything in its place" is the slogan of an "up to the minute" station operator.

The mere installation of fire protection appliances does not thereby furnish an assurance of safety. They must be regularly inspected and cared for. The persons employed where they are placed should be instructed in their use, and, where circumstances warrant, fire companies should be organized. The officers should be selected from among those who are ordinarily in authority, who have mechanical knowledge and whose duties insure their presence on the property. Each member of the fire company should be carefully instructed in the handling of the entire fire-fighting equipment. It is needless to say that cool-headed men should be chosen for fire service. Drills should be held at regular intervals and at other times to test the punctuality of the service. Attention should be given to fire service at night.

Having fire protection naturally includes the removing of conditions conducive to the occurrence of fire. This phase of the subject is of infinite variety, and in the limited scope of this paper can be but briefly discussed. Neatness and order, coupled with prompt removal of cast-off combustible material, can be put down as a rule of great value, and one which should be strictly adhered to. The removal of conditions which cause fire or which would cause its ready spread after having started is greatly to be desired. With our knowledge of the embarrassment of the electric light and power companies when an interruption of service occurs, we can readily see that every precaution should be taken to render generating stations, substations, switch houses, etc., as near fireproof as possible. No more combustible material should be used in construction than is absolutely necessary. All outside walls, division walls and partitions should be of fire-resistive construction. All windows should be of wired glass in standard metal frames; all doors should be of metal, or of wood which is metal-clad. Doors between sections should be standard fire doors. Small inclosed closets and other concealed spaces should be dispensed with as far as possible so that there can be no accumulation

of rubbish or unnecessary articles in any part of the station. Dust should not be allowed to accumulate, and especially does this apply in boiler rooms and coal quarters.

Storage-battery rooms should be properly ventilated and care should be taken in the wiring for lights and motors to avoid possibility of sparks or flashes.

Stock contained in buildings should be stored compactly, neatly and orderly and in such a manner as to render it as slow burning as possible and less liable to communicate fire from shelf to shelf and room to room.

Hay and excelsior should be removed from packing cases wherever practicable, or, failing in this, they should be isolated and rendered as safe as possible. Gasoline, benzine, benzoin, naphtha, collodion, and like inflammable products should be isolated and handled with care. Where a large quantity of gasoline is kept on hand, it should be apart from buildings and stored in an underground tank with an approved pump. Such small quantities as are for daily use should be drawn into and used from an approved safety can only.

Heating appliances used on benches, etc., should have metal or other fire resistives beneath them. Wiring, including switches, should be installed in a safe manner with due regard to surroundings.

Smoking should be prohibited in storerooms, paint rooms and other places where conditions warrant, and signs to that effect should be prominently posted and rigidly enforced. The use of wooden lockers and cupboards should be discouraged, as they furnish a hazard proportionate to the number of persons using them.

The use of extension cords should be discouraged except where absolutely necessary. Lighted lamps should never be placed on or near combustible or inflammable material. Self-closing cans should be provided for sweepings, rubbish, oily rags, waste, etc. These cans should have metal legs to raise them slightly above the floor.

In the extinguishing of electrical fires there is large opportunity for the display of good judgment and prompt action. The element of time is exceedingly important. The operator should observe whether conditions warrant the cutting off of current from the affected part before the fire is attacked. His knowledge of the apparatus under his charge should be such as to guide him promptly. Personal safety would discourage the use of Babcock or hose-line streams on apparatus in operation, or live current-carrying conductors.

Sand and powdered bicarbonate of soda have been found to have some merit as extinguishing agents in certain kinds of electrical fires, but their use is limited.

Where sand is provided for fire-extinguishing purposes, it should be carefully sifted through a sieve of fourteen mesh to remove larger particles, especially scraps of metal. It should be kept in a clean and dry condition and should not be used where there is a liability of its getting into the bearings of moving parts.

In tests recently made in extinguishing oil fires, wet sawdust impregnated with sal ammoniac has been found to have considerable merit.

Carbon tetrachloride has shown up well as an extinguishing fluid and has the advantage of being a non-conductor to a high degree, which is a very valuable attribute. In modern plants the liability of structural fires is vastly less than the liability of the occurrence of fire in apparatus, and much of this apparatus is so constructed that in case of fire occurring in the interior it is very difficult or impossible to use an extinguishing agent with success. Then, again, many fires on apparatus and conductors flash and quickly burn out, affording no time nor necessity for action.

It is impossible within the scope of this brief treatment of the subject to cover the entire field of operations; the operator must be depended upon to exercise his good judgment, which, in practically all cases, should be sufficient to master the situation.

Carbon Tetrachloride as a Cleaning and Solvent Agent.

Associated Factory Mutual Fire Insurance Companies.

(Member N. F. P. A.)

In recent years the use of carbon tetrachloride as a cleaning and solvent agent has considerably increased, owing partly to a decrease in its cost of production, and partly to a more widespread knowledge of its properties. The advantages which it possesses over naphtha in point of safety, with respect to both fire and explosion hazard, make this substance of considerable interest.

Carbon tetrachloride is a water white liquid, having, when pure, a pleasant, agreeable odor quite similar to that of chloroform. The commercial product usually contains sulphur impurities which impart a slightly disagreeable odor. The specific gravity of the liquid at 32°F. is 1.632 and the boiling point is 169°F. The specific gravity of the vapor is about five and one-half times as great as that of air and about twice as great as that of the lightest naphthas. The difference in specific gravities of the vapors of carbon tetrachloride and naphtha is not sufficiently great, however, to overcome the tendency which all vapors have to diffuse, one within the other, and the two vapors do not separate once they have become thoroughly mixed. The two liquids show no tendency to separate once they have been mixed.

Carbon tetrachloride is an excellent solvent of animal and vegetable fats, oils, varnishes, waxes, resins, mineral oils, paraffin, tar, etc.

It is non-inflammable and non-explosive. Combustion cannot take place in its vapor due to the absence of oxygen. For this reason it extinguishes small fires in enclosed spaces, when thrown upon them.

The toxic properties of carbon tetrachloride are of importance where large quantities are used, and no provision is made for removing the vapors. Its effect on the human system is the same as that of chloroform, producing anesthesia, although not as powerful in its action.

Until recently the cost of manufacture of carbon tetrachloride has been so great as to prohibit its general technical application, although for cleaning purposes, such as degreasing wool and removing oil and grease spots from finished cloth, it is fully as efficient as naphtha. Owing to this property, it is being used in a large number of patented preparations intended for use as cleaning agents, and is being sold under a variety of special trade names. These preparations sometimes contain other substances besides carbon tetrachloride, but they generally possess little or no advantage over the latter.

On account of its non-inflammability and the property of smothering small fires when thrown upon them, carbon tetrachloride is being sold today as a fire-extinguishing agent. In this rôle it has, however, disadvantages, owing to the liberation of large quantities of suffocating and poisonous gases, and the necessity of confining the vapor to the immediate seat of the fire.

In spite of the fact that there have recently been further reductions in the price of carbon tetrachloride, its high cost is still the one serious drawback to its more general application, but the many advantages which carbon tetrachloride possesses over naphtha in point of safety make its use very desirable wherever practicable. The cost can be considerably reduced in many instances by reclaiming the spent solvent by distillation and by taking advantage of the fact that a certain percentage of naphtha can be added without rendering the mixture inflammable.

Non-Inflammable Mixtures of Carbon Tetrachloride and Naphtha.

The importance of this matter of non-inflammable mixtures of carbon tetrachloride and naphtha led to a series of tests, undertaken with the object of determining how great a percentage of naphtha of various gravities could be added and still leave the mixture reasonably free from fire and explosion hazard. The following conclusions were drawn directly from these tests, the proportion referring to percentage by volume:

(1) The percentage of naphtha which can be safely added varies considerably with the gravity.

(2) 55° naphtha at ordinary room temperatures is practically free from explosion hazard, but in order to be reasonably safe from fire hazard it should contain at least 30% of carbon tetrachloride.

(3) 63° naphtha at ordinary room temperatures presents but slight explosion hazard, but in order to be reasonably safe from fire hazard it should contain at least 45% of carbon tetrachloride.

(4) 70° naphtha, in order to be safe from explosion hazard, should contain at least 50% of carbon tetrachloride, and to be reasonably safe from fire hazard should contain 60%.

(5) 76° naphtha, to be safe from explosion hazard, should contain at least 60% of carbon tetrachloride, and to be reasonably safe from fire hazard should contain 70%.

The expression "reasonably safe from fire hazard" is used advisedly, since the above mixtures, while possessing but little fire hazard in open containers, will burn if spread out over a considerable area, on any readily combustible material, such as cotton goods. The percentages of naphtha, stated in each case, are limiting ones, and good practice would call for an additional 5% of carbon tetrachloride in order to allow some factor of safety. If such mixtures were used the cost would not be prohibitive, especially if the solvent were recovered by distillation, where large quantities are needed, and what additional cost there might be over pure naphtha would be more than offset by the greater security to life and property.

In cases where distillation is carried on, the operation should be conducted in a safe location, since under certain conditions during part of the distillation pure naphtha may be obtained as a distillate. Owing to the fact that the above mixtures of carbon tetrachloride and naphtha will burn if spread on readily combustible material, they cannot be considered entirely satisfactory substitutes for pure carbon tetrachloride, and their use is recommended only in cases where the pure solvent cannot be used.

Fire and Water in the Cotton Mill Carding Department.

By George S. Brown.

Courtesy of COTTON.

There are two things that a carder especially dreads: One of them is fire, the other is water. Either of these two elements will produce havoc in mighty short order and since fire and water give more trouble in the picking and carding rooms than in any other place in the mill, a carder should know how to handle these emergencies. A few suggestions of a practical nature may be interesting if not beneficial.

The subject of fire is the one we will consider first. I have divided the subject into a number of parts; these include: "Causes of Fires," "Preparation," "Fighting the Fire," and then, under the heading of "Cleaning Up," I have included the question of water.

Causes of Fires.

Fires in the picker room are caused by nails, bits of iron, travelers, match heads, etc., that are in the cotton (usually waste) fed

to the beaters. The beater blades strike this foreign material and sparks ensue which frequently start a fire.

On a card, fires are caused by the licker striking a fragment of metal in the lap, by the licker clothing loosening up and striking the feed plate, by a card out of level making side waste which gets pinched between the cylinder and card frame, and now and then a smudge is started by a traverse grinder striking sparks, but a fire of this sort rarely does any damage on account of there being no cotton in the card.

Drawing frame fires are caused by cotton being wound in around the necks of the bottom rolls, and by "bung-ups" where the driving belt is not shipped onto the loose pulley, but stays on the tight pulley, around which it slips, producing excessive friction.

On the fly frames, the main causes of fire may be traced to dry spindle steps, spindles stuck in bolsters, and bobbins where the roving has run over the top and twisted about the spindle, where it gets inside of the bobbin and binds tightly.

Other causes of fires in the carding room, or, in fact, in any room, are hot bearings, from lack of lubrication, moving belts or pulleys chafing against trucks or cans shoved up against them, and belt shippers out of adjustment so that they chafe or come in contact with the belt or belt clamp. Stand in a room where the speed is running but the machinery still, and note the belt clamps that are clicking against the shippers. Every one of these is a fire menace. A moment with a wrench will usually remedy the trouble, which in most cases is caused by the shipper being struck with a roving box. Loose pulleys are another source of trouble. While it sounds very well for an overseer to say, "We never oil loose pulleys," meaning, of course, that when the speed is running so is the machinery; still there are times when the speed is run for an hour or so with the machinery idle. Dry, loose pulleys at a time like this are sure to call attention to themselves by screeching, rattling, and not infrequently by a flash of fire.

Preparation.

It is a very important matter to be prepared for fires, and that means to have things to work with, to have them in correct condition and in the correct places, and finally to know how to use them.

All mills are supplied with sprinkler systems, and if for any cause whatever the water is shut off from the system, be certain, be *sure* that it is again turned on as soon as possible.

In the picker section, lines of hose complete with nozzles and attached to standpipes should be in every room where there is machinery. See that bales of cotton, waste, or extra laps are not packed against these lines of hose so as to make them inaccessible. Liquid chemical extinguishers are also a necessity in the picker room as they will put out a big blaze without flooding the room.

Throughout the entire picking and carding department fire pails painted a conspicuous color should be hung in conspicuous places. These pails should be kept free of waste and all of the time well filled—say 1½ inches from the top, so as not to spill if slightly

jarred. Some overseers seem to think it the proper caper to fill the fire pails after a fire and not again until just before the insurance inspector gets to their department. A man who is tricky about this will be tricky about other things, and he ought not to be kept in a carding room.

If there is any question as to the shape of pail bottoms, the old-fashioned flat bottomed pail is the one to choose for practical use. I would prefer to avoid pails with rounded bulging bottoms. They are successfully designed in this shape to make it inconvenient for the help to use them for other than fire purposes, but they are just as inconvenient in actual use for small fires. You rarely ever need to throw at once an entire pail of water on a small blaze, but very frequently you wish to set the pail down to remove gear covers, etc., and your bulging bottomed pail rolls over. Once taken from the hook, you must hang onto this pail until empty, or, not finding a place to hang it, set it up in a corner. Quickness counts during a fire, and pails that stand alone assist in quick action. If the help legitimately need pails for other purposes, supply their wants, but have the pails painted a different color from those furnished for fire use.

A liquid chemical extinguisher is very handy around the fly frames.

A good rule to put in force in the picker room is to see that the help are acquainted with the location of all stand pipes, hydrants, lines of hose, nozzles, ladders, etc. Where chemical extinguishers are installed, the help should be instructed in their use. In this way, when any of these appurtenances are needed, the help can find them immediately and know how to use them. To have extinguished a small blaze by quick action and a quart of water is deserving of much more credit than to have extinguished a fire that by the inactivity of those present had assumed such proportions that it required several hose streams to quench it.

Fighting the Fire.

When a fire breaks out in a picker, the first thing to do is to stop the feed or break out the laps. Let the machine run so as to get the cotton out of it and thus prevent serious damage to trunking or cages. *Use the chemical extinguisher,* if possible, to save flooding everything in the immediate neighborhood, as well as wetting the room below if the fire happens in such a location. Don't hesitate to use a hose stream if necessary, but try to have the water put where it will do good, and not squirted about promiscuously, as is often the case.

As soon as a picker room fire is seemingly extinguished, make a careful and thorough search for any signs of fire in the immediate vicinity. Don't forget to examine the dust room, and if there is any accumulation present, have it cleaned out.

When a fire starts on a card, break out the lap and then, if water must be used, a brush dipped into a fire pail or a bunch of wet waste will be very effective. Try not to wet a card any more than possible.

Drawing frame fires are unusual occurrences, and when they do happen very little damage is done, especially if the frames are kept reasonably clean, as they should be.

On fly frames, the first flash generally cuts all the ends, and then the fire gets in under the gear covers and roller beam. A chemical extinguisher comes in handy in a case like this, but if it is lacking, don't throw water at the carriage and step rail covers, as it will do no good. Open the gear covers and splash water on the blaze with the hands. One pailful used in this manner will be more effective than a dozen merely thrown at the machine.

Quickness in getting into action is what counts. Make it a rule whenever the pungent odor of burning cotton comes to the nostrils to drop whatever is being done and search out the cause. Many big fires are avoided by finding and quenching a bit of smouldering material.

Whether using chemicals or water on a blaze, fight the flames beginning at the bottom and working upwards. Don't throw water through the blaze. Keep cool and put the water onto the material that is burning.

No matter where the fire happens to be, as soon as it is put out look into every nook and cranny about the machine for any particles that may still be burning. These, if overlooked, may break out into a blaze later, perhaps at night when nobody happens to be present, and a very serious conflagration result.

Cleaning Up.

As soon as a fire is under control, turn off water supply to stop any sprinklers that may have been opened by the heat, and prevent further and unnecessary wetting and damage. See that the master mechanic, or whoever looks after such work, immediately fixes or renews the open sprinkler heads, and then be *sure* that the water is turned into the pipes again.

Have all wet or smouldering cotton taken out of the building to avoid any further danger. Then pay strict attention to the machinery. Immediately set about drying it out. Wipe off every wet part with waste and then polish with dry waste and whiting or black lead to prevent rust. Get the machines running as soon as possible, as the air currents will assist in the drying process. When the first cotton is started through, throw plenty of whiting into the feed. Of course, burned parts of pickers, such as lattices, aprons, etc., will have to be renewed, but many times after a fire the damage proves to be nothing more than the actual cotton consumed.

If cards get their clothing wet, it is a good plan to remove as much of the casing around them as possible, and then start the cylinders and doffers, after stripping out all wet fibre. Apply the burnishing brush to wet clothing and dust on plenty of whiting or black lead. Wipe all plates and polished parts perfectly dry.

Whenever drawing frames or fly frames receive a wetting, they should receive a thorough scouring to prevent the rusting of rolls. The top rolls, if leather covered, should be wiped dry, and any that show signs of opening at the laps should be thrown out. Those

rolls that are varnished should receive a fresh coat before replacing in the machines. Every bearing should be oiled or greased thoroughly, and before starting up, any wet back-drawing or roving should be removed, or a bad mess will result when this stock reaches the rolls.

While it is a very excellent plan to make just as little waste as possible, still, in a case like this, if there is a chance that material is wet, make waste of it if it is drawing, or pack it away to dry if roving and not stained. A glance at the top of a can of drawing tells but little, for considerable water may be at the bottom. The frame may be started and run all right for a while, but sooner or later up comes a wet place and there is trouble. With varnished rolls this means changing the entire delivery for new rolls to be repeated later. Dump any suspicious looking cans.

If possible, have heat turned into the room and kept on all night to further assist in the drying process. See that all fire pails are refilled and replaced on their hooks. Recharge any exhausted chemical extinguishers.

Now and then it happens that a sprinkler head is accidentally opened. The two most frequent causes of this are: a belt breaking and one end of it hitting the sprinkler, or the striking of a sprinkler with a broom when brushing down the ceiling.

In some cases the sprinkler is opened sufficiently to blow a brisk spray that wets everything in the neighborhood. Then again, when a sprinkler is hit by a broken belt that has caught on the shafting and is banging the ceiling, the entire head may be knocked off and a deluge follow. If the escaping water comes directly down in a single stream, it will not do as much damage as it will if spraying in all directions and wetting things in a large circle.

When a sprinkler is struck and starts leaking, the first thing to do is to rush for one of the long-handled brooms used for brushing down the ceiling, if it is not already present, and jamb the head of this broom up tight against the leaking head to completely envelop it in a mass of broom corn. This will prevent the water from squirting in all directions and cause it to run down the broom handle in a single stream. Shove an empty drawing can under the handle and keep it there. Shut off the water from the sprinkler system and open the drain pipe to get the water out of the pipes.

Some mills have in each room where sprinklers are liable to be opened and do damage, a large funnel fastened to the end of a stick long enough to reach the ceiling. A piece of hose pipe sufficient to reach to the floor is fastened to the bottom of the funnel, and when a sprinkler opens the funnel is pressed up against the sprinkler pipe and the head enclosed, compelling the water to run down through the hose. If near a window, the end of the pipe is put outside and further wetting avoided.

If at any time a floor in one of the upper rooms gets flooded with water, which begins to leak down into the room below, the cards, or, in fact, other machinery can be protected by unrolling picker laps over their tops. A couple of layers of this material will

be almost impervious to water even if exposed for quite a long period.

Before closing this article, I wish to speak about one thing more, and that is leaky roofs. There is nothing much more discouraging than to try to operate a carding room successfully when the roof on the building resembles a sieve. Every rainstorm or snowstorm means trouble. There will be a drip here and a drip there. A few of these leaks will spatter water enough about to ruin many rolls and make sufficient waste (not to mention ruffled tempers) to almost pay for repairing the roof. A carder and his fellow workmen, working under a difficulty like this, deserve a whole lot of sympathy; but since his life is being made miserable by the roof, it is "up to him" to harp at headquarters about it and make life miserable for them until the trouble is remedied. When this is done, doubtless a good many fire pails that are scattered about the room as receptacles for dripping water will be returned to the hooks where they belong.

Copra Storage and Cocoanut Oil Refineries.

By R. B. Mathews and R. L. Rowley,

Assistant Engineers of The Board of Fire Underwriters of the Pacific.

(Member N. F. P. A.)

It is not the intention of the writers to go into the history of the copra industry, but to give a few facts and to point out the lessons learned from fires occurring in connection with various phases of it.

"Copra" is the name applied commercially to the dried, broken kernel of the cocoanut after it is split and ready for shipment. The word is a Spanish and Portuguese adaptation of the Malay "kopperah"—the cocoanut.

The product is gathered principally in the South Sea and tropical islands and shipped to concentration points by means of inter-island boats. The copra is then either shipped in bulk or sacks to market; in this case to the Pacific Coast states.

The cocoanuts are barked, split, dipped in sea water just prior to drying, dried and shipped. At the present time copra and cocoanut oil occupy a place of prominence in the commercial world; the value of the raw product is quite high.

As a vegetable oil product we find that cocoanut oil is the lowest in the table of all vegetable oils, arranged in the order of their liability to spontaneous ignition, determined by what is known as the iodine absorption table. It was discovered that vegetable oils vary in their liability to spontaneous ignition directly as their capacity for iodine absorption.

There are two principal cocoanut oil refineries in and about San Francisco Bay. The hazards of the refinery and manufacturing processes of the oil industry are well known, and it is not the scope of this paper to deal with this phase of the industry.

There has been no unsatisfactory experience with sprinklered copra warehouses in this section with the exception of fires mentioned in this report. The copra, as before stated, is shipped in bulk or sacks, and when received at the refinery warehouses is stored in bulk or sacks. So far as the writers know there have been no fires in copra when stored in bulk; all the difficulty has been with the sacked copra.

The sacks are usually coarse jute gunnies; these sacks absorb the oil and after a while have all the undesirable characteristics of a vegetable fibre and oil combination. Sacked copra is stored in

warehouses as any sacked product would be, as high as the space and facilities permit and from wall to wall.

These warehouses range from corrugated galvanized iron sheds to mill constructed buildings. The fire protection, and especially the sprinkler equipments are well installed, in accordance with good practice for the class of buildings in question. The water supplies are adequate; the supervision and care of the equipment good; nevertheless the results have been poor.

There were two marine losses at about the same time in the fall of 1916; one on the steamship "Wiakawa" with 250 tons of copra; the other on the steamship "Waimarino," with 350 tons. The causes of these fires are unknown; the fires occurred on the high seas which necessitated flooding one compartment of each boat. The copra was partially re-sacked and loaded on deck and was re-wet by salt spray from the ocean. The copra in sacks arrived steaming in San Francisco. It was re-handled and dried; and, according to the statement of the company handling the same, the salvage was complete. In other words, the salt water had not damaged the copra. Particular attention is called to this feature, the effect of salt water on copra. It is well known that fresh water starts a fermentation or souring of the copra; and if not dried at once this souring spoils the meat for all purposes.

There have been seven fires in two refineries and their warehouses of which we know, and there may have been others of which we have no record.

The first fire occurred at 4 p. m. February 15, 1909, in a copra warehouse.

The chief occupancy of the building in question was the storage of copra in jute sacks, weighing from 175 to 200 pounds each. The sacks were piled twenty high at the time of the fire and formed a solid block, covering the greater part of the north central portion of the warehouse.

The fire was discovered about 4 p. m. when the superintendent was notified. All hands at his direction pulled down sacks and applied chemical extinguishers on those which were smoldering. The smoke and extent of the fire were so great that an alarm was turned in. The fire department used chemical and small hose, no steamer being used, as the fire was not large enough nor hot enough, it being blind and smoldering. As the sacks were pulled out any fire discovered was extinguished and hose shut off at the nozzle to prevent water damage. The fire at no time burst into flame large enough to open any sprinkler heads, which were directly overhead. A careful examination of the sprinklers did not show any fusing of the solder or the edges of the struts of the heads.

The sacks burned and some copra was charred, but no copra was hot enough to burn. The greatest damage was from water and chemicals, the latter affecting the copra the same as water, the copra becoming rancid after wetting. Damage to sacks and building was small; damage to copra was considerable.

Copra is 65% cocoanut oil, but showed trifling signs of burning. This building was not damaged at all by the fire, except as holes in the roof were cut to let out the smoke.

The cause of the fire is not known. According to the iodine absorption value tables cocoanut oil is at the end of the list with a value of 9 as against 170 for linseed oil, the tendency to spontaneous ignition being directly proportional. The fire appeared to have started in a pile near the floor and probably smouldered some time before detection.

At the time the fire occurred the plant was in operation; the employees were storing copra recently delivered by barge from San Francisco across the bay. It is of particular interest that this fire occurred after a fire had previously been discovered and extinguished on the barge that same day.

The second fire, in a cocoanut oil refinery, was in an unsprinklered plant, since sprinklered, and little is known of it.

The third fire occurred in the refinery proper and is known to have been caused by loose ends of electric wires coming in contact and causing the grease and oil on the joists above to ignite. There were 50 sprinklers in the room, of which two opened and held the fire in check, which was completely extinguished by one chemical line from the city fire department.

One feature of this fire was the failure of the inside hose. The reel was 10 feet away and had 50 feet of 1½-inch rubber-lined hose. The watchman tried to use it, but the water would not flow through the hose. The city fire alarm box was pulled and the fire department responded.

Two days after the fire one of the writers inspected this plant and found the rubber lining of the hose absolutely destroyed, filling the hose jacket so that it was no longer of value. A further inspection of all the hose showed a similar condition or the rubber lining to be in the process of disintegrating.

The cocoanut oil saturated the cotton jacket and dissolved the cement and afterwards the hose lining itself. Inside of eighteen months the hose was rendered unfit for use. There were five or six different brands of this 1½-inch mill hose, and all suffered alike.

During an inspection of this plant in May, 1912, (previous to the fire) attention was called to the poor condition of the hose and the superintendent had an employee go over all the hose and test it, but apparently without result, thus illustrating the futility of having ordinary employees do inspection work. Samples of the hose were sent to the Underwriters' Laboratories for inspection. Only approved linen hose in glass front lockers should be used in properties of this class.

The fourth fire occurred in the meal elevator of a San Francisco plant on May 29, 1913, at 5:30 o'clock in the morning while the plant was in operation. The sprinkler alarm worked satisfactorily. The cause is not known, but most likely was friction in the elevator. One sprinkler head opened in the elevator and one outside and entirely extinguished the fire. The primary water supply had not yet been in-

stalled; the equipment was just finished and water had been in the gravity tank only a few days.

The fifth fire occurred in the warehouse at the Berkeley refinery on March 23, 1916, at 7:16 o'clock p. m. Alarm was turned in by the watchman through American District Telegraph watchman and fire alarm box. The Berkeley fire department responded. The fire started in the northwest corner under the floor and spread under same from west to east and to the center of the building. The cause apparently was from an outside source, such as a spark falling in combustible material. Part of the sides and one-half of the floor burned and fell in. The fire was not sufficient to open more than a few sprinklers, which were not effective due to the dense storage of cocoanut meal and copra. The system was shut off when it was found that it could be of no value. Some heads were damaged by axes and fire streams. This was the second fire in this warehouse not controlled by sprinklers. The storage was in sacks piled very high and from side to side, there being no vacant aisles or spaces.

The construction of the building was faulty, in that the floor should have been concrete or of incombustible material and the sides should have extended below the floor level.

The sixth fire occurred in the San Francisco plant on February 5, 1917, at 10:38 p. m. The main plant was in operation, but the portion of the plant, in which the fire occurred, had not been in full operation since the preceding Saturday. The class of this property is an oil manufacturing plant and refinery, mainly the manufacturing and refining of cocoanut oil from copra.

The specific occupancy was that of temporary storage of copra in jute gunny sacks. This building was intended for mill and oil storage in the first story and basement; upper stories for the storage of oil cake and meal. Copra in sacks was solidly piled from wall to wall and from the south end towards the center or north of these floors. The only floors damaged in this fire were the basement and first and second, the basement only from a water damage standpoint due to the fact that oil tanks were located in this section. The fire itself, with its resulting water damage, was on the second and first.

The fire originated in the center of the south portion of the first floor and extended to that portion of the floor directly above.

This building was a three-story and basement mill building with sub-standard features; walls 16 inches and 12 inches with openings on three sides. East party-wall blank. Roof, tar and gravel and composition over 2-inch boards on 6x6-inch beams on 8x8-inch girders and 8x8-inch posts. Eleven 4x16-feet wired-glass metal frame skylights; stair and elevator pent houses and working copra bins all 4-inch crib construction, metal lined, rising above roof. Floors 8-inch crib with 1½-inch surfacing with paper between, on 22x24-inch girders on posts 14x14 inch, second story, to 20x20 inch in basement. Posts, 16 feet on centers; bays, 14 feet wide.

The sprinkler alarm notified the watchman of a fire, and he promptly turned in alarm through the auxiliary fire alarm box on

the premises. The alarm was likewise turned in over American District Telegraph Company's watch box on the premises. The watchman was on a two hourly round schedule, due to the fact that the plant as a whole was supposed to be in operation, recording his rounds through a combination fire and watch box service. From the records of the A. D. T. Co. the watchman started his 9 o'clock round at 9:36 and operated the box located in the first story at the elevator shaft where the fire occurred at 9:59. The sprinkler alarm of the water motor type was connected with a wet pipe valve. This operated satisfactorily.

To the best of our knowledge the cause of this fire was spontaneous ignition of cocoanut oil in connection with jute gunny sacks piled so as to restrict ventilation, with high storage such as to cause considerable weight at the bottom of piles. There is nothing in this portion of the building to indicate any special hazard, either electrical or smoking, as the cause of this fire.

The storage of copra in jute gunny sacks is usual in the manufacture of cocoanut oil in this vicinity. This storage was compact from wall to wall and extended to within two or three feet of the ceiling. There were no vertical or cross aisles in the story where this storage was and no openings to allow free circulation of air in and around the sacks. The inside hose system in this building was without avail as the fire was beyond control when water was turned on.

The San Francisco fire department received its first alarm at 10:38 and responded with first alarm detail. At 10:57 a second alarm was turned in and at 1:21 a special call for 25 men was sent in. The last company reported back to quarters at 4 a.m.

The fire boat did not pump salt water from the bay on this fire. Its crew, in connection with the high pressure tender operating in conjunction, ran two lines from the high pressure hydrant nearby. Salt water was not used because it was thought it might have a disastrous effect on the copra; whereas the opposite is the case. The sprinkler equipment was shut off immediately upon the arrival of the fire department. Later, after the fire gained further headway, the water was again turned on and discharged through the sprinklers that had opened. The value of the sprinklers in this fire was that they distinctly held the fire in check, gave the alarm, and protected the building from anything but nominal fire damage. The relative loss, so far as the building was concerned, was small; the estimated loss upon contents was very great.

The water loss on the contents may be attributed to the lack of suitable water-proofing between the surface flooring and the crib flooring and to the fact that the columns were not flashed properly where they penetrated the floor; also the fact that the refined oil tanks containing cocoanut oil in the basement were not provided with covers and the water dripping through the upper floors displaced this oil, causing the tanks to overflow and oil to be spread over the basement floor. Had the storage of copra in sacks in this building been separated into small areas with cross openings or aisles

so that sprinklers would only open over the direct location of the fire in any one pile, the loss, no doubt, would have been much less. The fire ran in small voids between the sacks and caused heat to rise over the entire floor area, which opened up a large number of sprinklers.

There was a small opening, perhaps ½ or ¼ of an inch wide by 8 or 10 inches long in the floor next to one of the columns. The floor not being properly flashed, the fire spread from the first floor ceiling to the second floor, which, likewise, had copra piled directly over this opening. This occurred in two instances in diagonally opposite columns in the same bay, showing that even small and insignificant openings may cause a spread of fire doing much damage.

The seventh fire occurred at Berkeley plant on June 2nd, 1917, at 1:51 o'clock a. m. and was caused by oil and refuse igniting on what was supposedly a fireproof floor. Fire extended to the fourth and fifth floors by means of oil on the side of the steel building. Eight sprinkler heads opened and gave the alarm and held the fire in check, which later was extinguished by chemical lines from the Berkeley fire department. The damage was nil.

The building in which this fire occurred is a steel frame building supporting a considerable weight in filters and a large tank structure containing two tanks, one for domestic use and the other the secondary sprinkler supply. The building is sheathed outside with corrugated galvanized iron. The floor where the fire occurred was constructed of boiler plate and the entire surroundings were incombustible except for the oil accumulation and refuse on the side of the building and floor. After the arrival of the fire department the sprinkler equipment was shut off and put back in service before the department left the premises.

It is the opinion of the authors that copra should not be stored in sacks; concrete or steel bins should be used and a worm feed conveyor used to carry the copra to the mill.

Cocoanut oil refineries, in addition to the pressing and refining of cocoanut oil, also make oil cake and meal. These two commodities are used for animal feed of one nature or another and for fertilizer; the meal is marketed in sacks.

The proper method for storing copra from a fire protection standpoint is in bulk. When, for some reason or other, it may become necessary to store it in sacks, good fire protection demands that the storage be distributed on skids separated by aisles at least two feet wide so as to limit the area of compact storage to about 400 square feet. There should also be a two-foot space between the storage and outside walls or partitions of building or room where stored.

This method of storage would allow either the sprinklers or hose streams to confine the fire to a small area and prevent the fire from running in the voids between the sacks the entire length of the building.

An item of considerable importance in buildings of more than one story in height where copra is stored, or for that matter any

storage of a like nature under sprinkler protection, is the waterproofing and draining of floors.

For sprinkler equipments in warehouses of this nature, control valves should be outside the building with post indicators. Where this is not possible the storage should be so arranged that valves are readily accessible either day or night. A single valve is preferable to floor control for occupancies of this kind, so as not to complicate the control feature.

Sprinkler protection is seriously handicapped by the prevailing method of storing sacked copra.

Factory buildings with improper storage arrangements should not be used for temporary storage of commodities. More attention should be paid to construction details with storage methods carefully planned, particularly in buildings of more than one story in height of the rated better class.

Copra storage in bulk might be arranged so that the bins used for this storage will be separated into small compartments so as to localize either fire or water damage as a result of fire occurring in the bottom or lower portion of any bin.

Fire Protection in a Penitentiary.

The proportion of penitentiary inmates possessing any fire prevention consciousness is probably extremely small. This circumstance is fortunate, not merely for the reputation of fire prevention, but also for the peace of mind of the convicts, if the conditions reported by the Missouri Inspection Bureau (Member N. F. P. A.) as existing in the State Penitentiary at Jefferson City are at all typical.

During 1916 four serious fires occured at the penitentiary—one in July, the other three in September. Incendiarism by the convicts was popularly supposed to be the cause in each case, but, as the Bureau with gentle irony observes, in its report on the first fire, "faults in structure of the building and in care of hazards, as judged by conditions in other buildings, might cast a possible doubt on this theory." The whole-hearted and determined work of the convicts detailed to fight the fires—with the single exception of a man who urged his fellows to "let her burn down," and who was forthwith subjected to "stringent measures"—might also be regarded as tending to discredit the theory of incendiarism, although it is by no means conclusive. As the report points out, quite apart from those who harbor feelings of revenge against society at large, or the prison management in particular, some of the convicts would probably take the risk of setting a fire for the sake of escaping "the monotony of prison existence," to say nothing of the chance of distinguishing themselves in the fire-fighting and possibly getting a parole. That such considerations should have to be taken into account is a sad commentary on the present state of the science of

penology; but the connection between arson and intolerable monotony is not confined to prison life. There have been several reports of fires in factories set by workers who had become half-insane under the unending sameness of their tasks, and were willing to take big risks for the sake of a little excitement.

Turning from the hazards created by the low morale of the convicts, it is worth while devoting a few lines to the hazards created by the low morale of the management. We will let the report of our member speak for itself:—

"General conditions as to care, cleanliness and maintenance were poor, judging from conditions as found in the existing buildings soon after the last fire, as well as from prior reports. The premises were crowded with machinery and cluttered up with wooden lockers. Cutting tables, shelves and benches were built with concealed spaces at floor. Workmen's seats were mostly made out of inverted packing boxes, with, usually, a concealed space underneath which would be utilized as a catch-all for various kinds of plunder. Sawdust or leather chips were uniformly used in cuspidors. No receptacles for oily waste were provided and no provision for the regular disposition of waste cuttings or rubbish. Stock, wood, rags and clothing were found in contact with heating pipes generally. Wiring, both power and lighting, was in a uniformly poor condition, with a mass of "dead ends" hanging about. Sawdust was used for sopping up overflow in the oil house. This building was old and in ruinous condition."

The structural features of the buildings affected are thus described in the report:—

"The fires occurred in four buildings (Nos. 1, 2 and 4, and Oil House), all of which, with the exception of a one-story addition to Building No. 2 and the Oil House, which were of ordinary brick, were of the same general type of construction—namely, brick supporting walls, with floors above grade and ceiling of top story of circular brick arches sprung between unprotected I-beams sup-

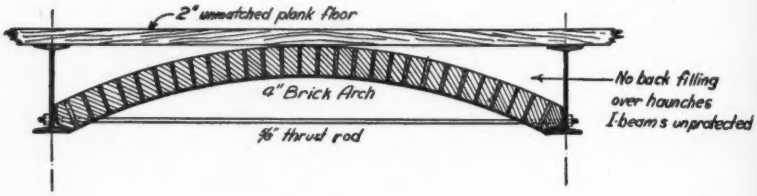


DIAGRAM OF TYPICAL FLOOR ARCH
As found in Buildings No 2, 3, 5, 6, 7, 8, 9.
Missouri State Penitentiary, Jefferson City, Mo.

ported on I-beam girders and cast-iron columns, entirely unprotected. A two-inch plank floor was laid over the arches, the space between the haunch of the arches and the planking being left vacant. A peculiar condition was found in the third floor of Building No. 4. This was originally a two-story building. When adding the third story, the ceiling arches were left undisturbed and a false floor, again supported on unprotected I-beams, was laid some 30 inches above the top of the arches. The space between the top of the arches and the false floor was not cut off at elevator and belt hole openings. The diagram below shows the type of floor construction.

Stair and elevator openings were in the open and unprotected. The first three buildings were large in area, averaging about 10,000 square feet on the ground floor."

The occupancy of the buildings was: Building No. 1, as a clothing factory; Building No. 2 as a broom factory; Building No. 4 for storage of stock, cutting and sewing, for a clothing factory, and the Oil House for storage of leather cement, shoe varnish, gasoline and lubricating oil for a shoe factory.

The circumstances attending the four fires throw an interesting light upon the ideas of the management on the subject of fire protection. A considerable time elapsed before the chief of the small city fire department was notified of the first fire. He received his first information concerning it from a passer-by, who asked him whether he was going to make a run to the prison. Shortly afterwards he received a telephonic request for aid. The fire was first fought by guards on duty and employees in the plant, together with about 60 convicts detailed for the purpose. A line of hose was laid from a yard hydrant, but considerable difficulty was found in opening the hydrant, and it is surmised from the poor flow of water that it was never completely opened. Owing to the large quantity of inflammable material in the building (No. 1), the fire was soon beyond the control of the private department, and there was some delay in getting the public fire engine through two sets of large gates. On its arrival, the pressure at the private hydrant was found to be too low to warrant the attachment of more hose, and a line of hose was therefore strung over the wall to the public hydrant in an adjoining street. By this time the floors had begun to collapse, and the building became a total wreck. All of the floors, as well as the roof, collapsed completely, and the steel work was twisted into an almost inextricable mass.

The second fire occurred in Building No. 2. Although several weeks had elapsed since the first fire, the defect in the yard hydrant had not been repaired, and the water supply was consequently poor. The Fire Chief did not bring his truck within the prison walls, but ordered an immediate connection to the public hydrant. The fire was confined to the one-story portion of the building in which it originated, the roof being partially destroyed and the stock of broom corn considerably damaged.

Nine days later the third fire was discovered in Building No. 4. A line of hose was laid from the same defective hydrant as before. Not only was it still unrepaired, but the nut had been badly abraded from previous attempts to open it. The Fire Chief, knowing the condition of this hydrant, wasted no time upon it, but at once laid a line over the wall. It was found possible to confine the fire to the third floor of the building, though some water damage resulted on the lower floors. The roof, the third floor and its contents, including the wooden false floor over the brick arches, were completely destroyed. The floor arches themselves held well, even under the falling weight of structural steel and debris, proving that the mechanical strength of these arches is great, so long as the steel work is not buckled by heat.

The fourth fire, occurring after an interval of five days, was a small one, but owing to the age and condition of the Oil House,

where it originated, little was left of the building when the blaze had been extinguished. The process of extinguishment occupied only a few minutes, as there happened to be, at this end of the yard, a hydrant which was in good repair. The services of the city department were not required.

Sugar Refineries.

By R. E. Swearingen,

Engineer Fire Prevention Bureau of the Pacific, (Member N. F. P. A.)

Ordinary sugar is a carbohydrate, chemically known as sucrose to distinguish it from other carbohydrates such as glucoses, which are also sugars. It is soluble in half its weight of cold water and in much less hot water, but insoluble in turpentine or alcohol.

Sugar is found in many plants, including sugar cane, sugar beet, sorghum and the maple tree, but practically all is obtained from sugar cane and sugar beets. Pure sucroses are identical irrespective of their sources.

The total consumption of sugar in the United States is about four million tons annually, of which about 75% is cane and 25% beet sugar.

Practically all beet sugar used in the United States is of domestic production. Of the raw cane sugar used, about 60% comes from Cuba, 17% from the Hawaiian Islands, 10% from Porto Rico, 7% from Louisiana, and a small amount from the Philippine Islands and foreign countries. Practically no refined cane sugar is imported.

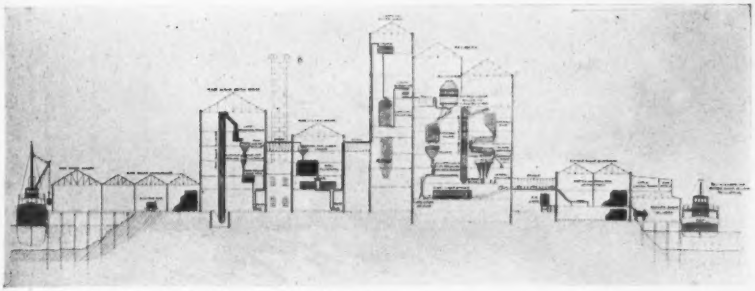
Prior to the present European war, approximately half of the world's sugar was produced from sugar cane and half from sugar beet, but at present the ratio is about two to one on account of curtailment of beet sugar production in Germany.

This article is to cover the processes of cane sugar refineries as distinguished from sugar mills, where raw sugar is produced from sugar cane, and from beet sugar factories where refined sugar is made from the sugar beet. Sugar mills or sugar houses are located in sugar cane producing districts, and in them the cane is crushed and the juice extracted, then purified, evaporated and crystallized into what is known as "raw" sugar.

Raw sugar is deep brown in color and contains as impurities ash, glucose, water and organic matter. It is bought on a basis of 96% sucrose.

Refineries in General.

Cane sugar refineries are located in seaports, as practically all raw sugar comes from tropical or semi-tropical countries. Ample docks and railroad facilities are necessary, also an abundance of water for condensers, melting and washing purposes.



Courtesy Western Sugar Refining Co., San Francisco.

Elevation of a modern sugar refinery showing relative position of principal machinery.

Refineries usually consist of the following buildings, sections or units: Raw Sugar Warehouse, Melt House, Char House, Refinery, Refined Sugar Warehouse and Power House. The Melt or Wash House will sometimes be found as part of the refinery, and occasionally separate warehouses will not be used for raw and refined sugar. Construction has generally been heavy or ordinary joisted brick, although the present tendency is towards fire-resistive construction for the main buildings, which is greatly to be desired on account of their height and weight of machinery.

Refinery or pan house and char house buildings are usually from 6 to 12 stories high, melt houses about 6, and have numerous unprotected floor openings, most of which, however, can and should be protected.

They are operated day and night except Sundays. It is customary to close the entire plant once a year for about a month to make necessary repairs and changes.

Processes.

The principal processes in order are: Raw sugar receiving and warehousing, washing, melting, defecating, bag filtering, char filtering, char reclaiming, vacuum boiling, separation of sugar and syrup, granulating or drying, bolting or screening, and packing. In addition, numerous other processes are carried on, though not directly refining operations, such as bag washing, bag making and printing, chemical laboratory work and pipe, machine, forge and carpenter shop work.

Raw Sugar Storage.

Raw sugar is usually received at the dock in burlap or gunny bags holding from 125 to 350 pounds according to the custom of the country where it is produced. Philippine sugar is packed in fibre mats holding 70 pounds, and Java sugar in bamboo baskets holding from 400 to 600 pounds. From the dock it is carried by hand trucks, belt conveyor or small electric car to the raw sugar warehouse, where it is stored in the original container until used.

Washing.

The first refining process is the washing off of the molasses surrounding the sugar crystals. To do this the raw sugar is conveyed to the wash house, where it is "mingled" or mixed with syrup to form "magma." A set of crushing rolls is used to break up caked sugar before going to the mixer. The latter is a long steel tank with a revolving horizontal mixing or stirring shaft in the bottom. From the mixer the magma is dropped into centrifugal machines on the floor below, where the syrup is spun off and the remaining sugar is washed with a spray of water. These centrifugals are perforated baskets, open at the top and supported by vertical shafts. The basket is lined with two fine mesh screens, and is enclosed in a stationary outside casing. The baskets are revolved at a speed of 1000 to 1100 revolutions per minute; the centrifugal force spins off the syrup, the sugar being retained by the inside screen in the basket.

Melting.

The washed sugar is then dropped from the centrifugal into the melter on the floor below, where it is dissolved in hot water. The sugar solution is called "liquor."

Blow-Ups.

The liquor is then pumped to blow-ups, which are steel or iron tanks. Here it is heated by steam coils and agitated by means of air forced through perforated pipes. The mixture is treated with phosphoric acid and milk of lime, which precipitate the impurities. The next process is the removal of the suspended impurities, which is done by means of bag filters.

Bag Filters.

These are made up of from 400 to 500 closely woven, cotton filter bags, 6 feet long and 28 inches wide, each of which is enclosed in a coarse outside bag or sleeve 6 inches in diameter, which keeps the inside bag folded and increases the filtrating surface. A brass thimble, known as a "bottle," is tied into the open end of the bag, by which it is fastened to the bottom of the shallow tank at the top of the filter. Bags are suspended close together and all enclosed in a metal chamber. As the liquor runs from the tank to the bag, the suspended impurities are retained, permitting the clear, straw-colored liquor to filter through. After a time the bags become clogged with impurities and must be washed.

Laundry.

The "tired" filter bags are removed from the bag filter and, after the bottles are untied, the inner bags are pulled out of the sleeves. The sleeves are washed and dried in a laundry centrifugal. The inner bags are washed, then turned inside out, again washed, passed through a wringer, again washed in a laundry washing machine, then dried in a laundry centrifugal. The clean inner bags are then slipped into the washed sleeves, a bottle tied in each, then taken

to a filter and the bottles screwed into position, and are ready for use again.

Char Filters.

After leaving the bag filters, the liquor contains coloring matter and some soluble impurities, which are removed by filtration through bone-char or bone-black.

Char filters are large cast-iron cylinders about 10 feet in diameter and 15 to 18 feet high, holding from 30 to 50 tons of char. The top of the filter is provided with removable cover for charging with char. The char is supported at the bottom of the filter by a false bottom covered with filter cloth through which the liquor filters, but which retains the char.

Liquor is introduced into the filter through a pipe at the top, and it slowly percolates through the char by gravity, the clear liquor being drawn off at the bottom.

Char Kilns.

After the char has been in use for some time, it becomes "tired" or clogged with impurities, and must be revivified. The liquor is forced off with compressed air, and then the remaining liquor is washed out with hot water, after which the sweet water is forced out with compressed air. The char is then washed with hot water and the filter drained, after which the washed char is drawn out of the filter through a manhole at the bottom. Wet char is then dropped into large iron hoppers, then into driers where most of the moisture is driven off by hot gases from kilns below.

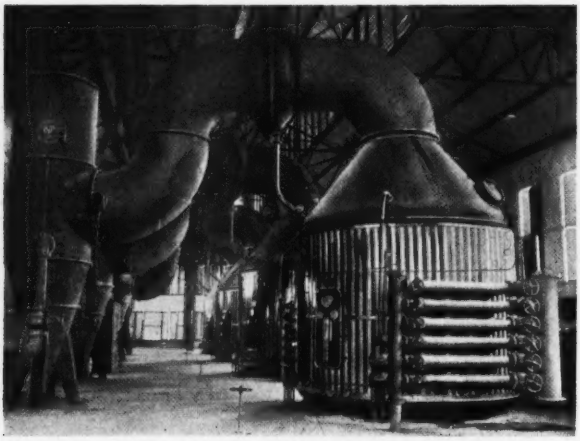
Kilns are constructed of metal and brick, heated by direct fire with either coal, coke or oil fuel. Dried char drops into vertical iron pipes known as "retorts," extending through the furnace; these pipes become red hot from the intense heat of the fire around them. Here the impurities in the char are burned out and its decolorizing and filtering properties are restored. Hot reclaimed char is then cooled by being spread out on the floor below or by being passed slowly through cooling pipes directly beneath the kiln.

Char is then elevated to the upper story of char filter house for use again after being run through a separator, where the finely broken or powdered portion is removed. The manufacture of bone char is not carried on in sugar refineries, but there is a considerable loss of char which is replaced each day.

Vacuum Pans.

The next process is the concentration of the pure white liquor from the char filters to sugar crystals by means of vacuum pans. These pans are of copper or iron and asbestos or wood lagged, heated by steam coils.

They are of various sizes, 10 to 17 feet in diameter, and usually extend through two floors. The liquor is boiled at a temperature of 140 to 190 degrees F. until grains appear, when more liquor is slowly added until the crystals have reached the desired size. "Massecuite," the mixture of sugar and syrup, is then drawn off the



Courtesy Baeuerle and Morris, Philadelphia.

Vacuum Pans.

bottom into a mixer beneath, where it is stirred with a mechanical mixer to keep the crystals in suspension.

Crystallizers.

Crystallization of some sugars is completed in large horizontal cylindrical steel drums known as "crystallizers." In these the "massecuite" is stirred continuously but very slowly from 24 to 48 hours, by means of mixing arms on a steel shaft. This gradually builds up the sugar crystals.

Centrifugals.

The "massecuite" is then dropped into centrifugals, where the syrup is spun off and the crystals washed with cold water, leaving the white crystallized sugar. The syrup contains considerable sugar and is again boiled in the pans. After the process has been repeated several times, the resulting syrup contains only a small amount of sugar, and is sold as molasses for manufacturing purposes.

Driers or Granulators.

After leaving the centrifugals, the sugar is refined, but contains a small amount of moisture which must be removed or the sugar will harden in the barrel or bag after being packed. This is done in large rotating steel cylinders called driers or granulators. They are supported at a slight angle by outside circular tracks on wheels, rotated by means of spur gearing. The inner surface of the cylinder is equipped with wings or buckets by means of which the sugar is lifted to the top of the shell and showered to the bottom. The inclination and rotation of the drier cause the sugar to gradually work its way from the upper end, where it is steadily fed into the drier to the lower end, where it is discharged through a spout.

Courtesy Kilby Manufacturing Co., Cleveland.
Centrifugals.

Driers are heated by hot air or by internal steam drums, both types being generally used, the sugar being first passed through a drier of the hot air type, where most of the moisture is removed, and then through one of the steam drum type, where the remaining moisture is removed.

In the hot air type, air is heated by being drawn through steam coils at the lower end of the drier by a fan or blower at the upper end; the hot air being drawn through the sugar.

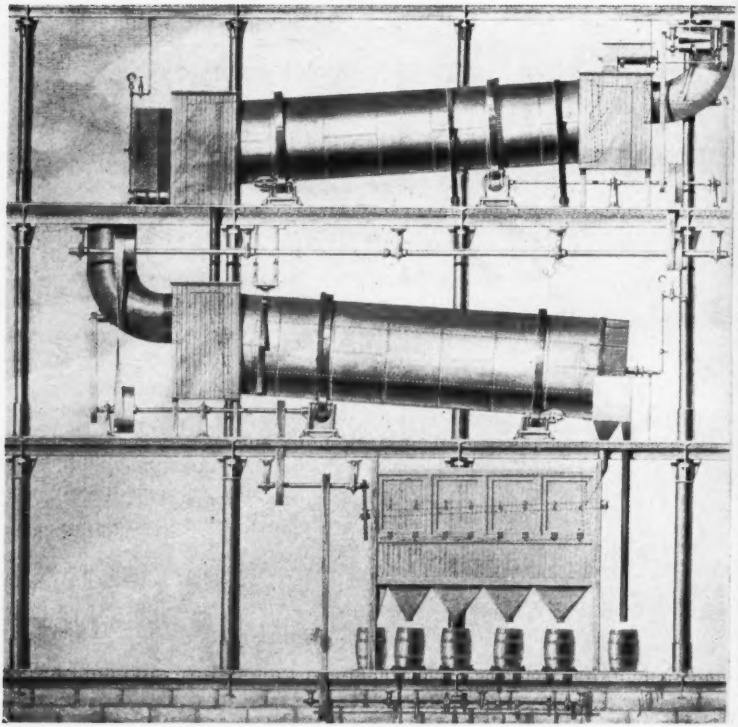
In the other type, the sugar is dried by being showered on the hot steam drum. Moist air is drawn off by a fan at the upper end.

Grading.

The refined sugar crystals are of various sizes, and must be separated into different grades according to their size. The size of the grains can be regulated to a limited extent in the vacuum pans, but it is impossible to do so exactly or to make the crystals of even size. Grading is done by different types of separators, screens and bolters.

Cube Sugar.

For table use, considerable sugar is pressed into cubes and then dried until hard. A high-grade, fine-grain sugar is used, which is taken direct from the centrifugals without being dried in the granulator.



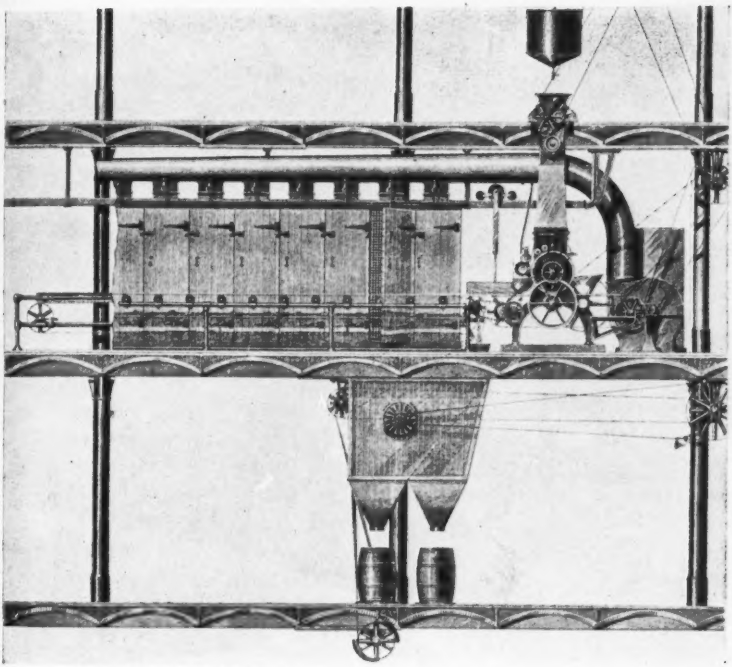
Courtesy Hersey Manufacturing Co., Boston.

Sugar Driers or Granulators.

The Hersey Sugar Press consists primarily of a cylinder, the surface of which is filled with cube-shaped moulds, the bottom of each being a movable plunger. Sugar is fed to the press from a hopper above. As the cylinder rotates, it passes a stationary bar against which the sugar is compressed by the plunger. Cubes are then forced out of the mould on to metal plates or trays beneath the press. The trays are carried by a belt conveyor to dry rooms or "ovens," where the cubes are dried. The driers are sometimes of frame construction, heated by warm air to a temperature of 160 degrees F. A temperature greater than this will discolor the sugar.

Powdered Sugar.

Powdered sugar is made of special hard grain sugar, ground or pulverized very fine between rapidly revolving rolls or by attrition mills. After being ground, the sugar is bolted in a revolving screen or reel covered with fine silk cloth. Powdered sugar is classified as fine, standard and coarse.



Courtesy Hersey Manufacturing Co., Boston.

Complete Cube Sugar Plant showing press, drying ovens, warm air blower and waste sugar screen.

Brown Sugar.

Brown or yellow sugars are known as "soft" sugars by the refiners. They contain various proportions of molasses, according to the grade, of which there are many, varying in color from nearly pure white to dark brown.

Soft sugars are made of lower grade white sugar liquors from the centrifugals. They are boiled in vacuum pans, but to a finer grain and at a lower temperature than granulated sugars. Each successive boiling produces a lower grade, and darker colored sugar, until the final molasses is left. These sugars are not dried.

Packing.

Most refined sugar is packed in paper-lined wooden barrels holding from 340 to 350 pounds, or in cotton-lined burlap bags holding 100 pounds, but considerable is now packed in cardboard cartons holding from two to five pounds, and in cotton bags holding from two to fifty pounds.

The weighing and sewing machines are usually automatic, as are also the carton gluing and sealing machines.

Bag Making.

The burlap bags for the refined sugar, together with the cotton bags for lining same, are sometimes made at the refinery.

Name of refinery, weight and grade of sugar are then printed on the bags.

Raw Sugar Bag Washing.

After the raw sugar has been emptied from the burlap bags some sugar remains; this is washed out, the solution being called "sweet water," from which the sugar is afterwards extracted. The bags are then passed through wringers, after which they are thoroughly dried, sometimes by the waste heat in front of the char kilns, or in the upper part of the boiler house while suspended from rope conveyors. In some cases bags are dried in open air in yard or on the roofs of low buildings. Steam-heated driers are sometimes provided for this purpose.

Shops.

On account of the large amount of machinery, piping and electrical equipment about a refinery, numerous shops for making necessary repairs and improvements are always found. These consist of sheet metal, pipe, forge, carpenter, machine and electric shops with the usual processes.

Common Hazards.

Sugar refineries are, without exception, very large and the amount of power necessary for their operation is great. Their boiler capacity must be large on account of amount of steam necessary for the vacuum pans, liquor pumps, heating tanks and driers. Both coal and oil are burned for fuel, the latter being used exclusively on the Pacific Coast. Boiler house should be cut off from main buildings.

Power distribution is generally electric and is the most desirable when properly installed in accordance with the National Electrical Code.

Special Hazards.

The special hazards of a sugar refinery are comparatively light, for from the time the raw sugar is washed until the refined sugar is dried, the sugar is in a liquid, semi-liquid or wet state and practically incombustible.

There is little or no hazard in the melters, mixers, filters, vacuum pans, centrifugals or liquor tanks, as they are of iron or steel construction, heated by steam coils. Unslacked lime for use in the blow-ups should be stored in a detached shed.

In a char house of fire-resistive construction, the hazards of the char kilns are light. Char should be cooled by passing through metal pipes or on a fireproof floor. The legs of the elevator which carries the char to the top of the char filter house should be of metal. The char separators should be connected to a dust collector.

There is but very little hazard in the cube sugar driers, as the temperature is not allowed to exceed 160 degrees F. They should be constructed of incombustible material.

The most important hazards in a refinery are in the sugar pulverizers and in the disposal of the very fine sugar dust from the pulverizers, bolters, driers and granulators. The pulverizers should be well located and equipped with magnets and screens to keep out pieces of metal and other material which might otherwise strike a spark in the machine. It is essential that the dust be removed from the machine in which it originates, in a manner to prevent it from floating in the air and settling about the building. Dust producing machines and conveyors should be vented to outside of building. All open fires and lights and electrical devices emitting sparks should be excluded from rooms liable to contain sugar dust. Machinery and processes producing sugar dust should be segregated in a separate building.

Sugar dust produced in driers and other apparatus, when carried away by an exhaust fan, should be collected and the sugar dust thrown down in a water-showering device.

There is some hazard in the bag factory, chiefly that of lint around the sewing machines and printing presses. The latter should be set on metal if floor is of wood. The bag department should be in a detached building and kept clean, which will reduce the hazard to a minimum.

There is no hazard in sugar bag and filter cloth washing, but there may be considerable in drying the washed bags unless done in a proper manner.

Protection.

On account of the size of sugar refineries and their heavy congested values, adequate fire protection equipment is of great importance even though the hazards are relatively light. Sand pails, standpipes and hose, water pails and private fire alarm systems are recommended.

Automatic sprinkler systems offer the best fire protection, and should be installed. They should control any fire occurring in a modern refinery, though their efficiency is somewhat reduced unless floor openings are properly protected. There have been sprinkler failures in sugar refineries caused by explosion of sugar dust.

Private outside protection and private fire brigades are desirable and often necessary on account of the location of the plant.

Fire Record.

Data regarding 43 fires is available in the records of the National Fire Protection Association, as follows:

Common Hazard Causes.

Smoking	4
Fuel Oil	4
Sparks from Boilers	2
Gasoline	2
Miscellaneous	7

Special Hazard Causes.

Sugar pulverizer	4
Spontaneous combustion in piles of bagged sugar	2
Excessive heat from drying coils	1
Friction in conveyor	1
Spontaneous combustion of jute bags	1
Choking of elevator leg with pulverized sugar, which caused friction between driving pulley and belt	1
Sacks overheated in drying	1
Heat from boiling kettles	1
Sparks from blowers connected with sugar driers and dust house, or explosion of dust in pulverizer	1

Summary.

Common Hazard Causes	19, or 44.2%
Special Hazard Causes	13, or 30.2%
Unknown Causes	11, or 25.6%

In eight cases no claim was made; in twenty the loss was small; in twelve the loss was large; no data is available on the remaining three.

Ten of the large losses occurred in unsprinklered and two in sprinklered risks.

Causes of the large loss fires were:

Unknown	5
Fuel oil systems	3
Spontaneous combustion in bagged sugar (one sprinklered)	2
Smoking	1
Spontaneous combustion of jute bags	1

The writer is indebted to Mr. W. E. Murray, Manager of the Western Sugar Refining Company, San Francisco, for many helpful suggestions in the preparation of this article.

References.

"Manual of Industrial Chemistry."—Rogers and Aubert.
"Something About Sugar."—G. M. Rolph.
"Outlines of Industrial Chemistry."—F. H. Thorp.

Department of Fire Record.

Groceries—Fire Record.

The importance of conserving foodstuffs at the present time gives a special interest to the fire record of groceries, and these properties have accordingly been segregated from the rest of the mercantile establishments with which they have in the past been tabulated. Even so, it is to be remembered that the record of grocery fire waste is not by any means completely covered by the record of fires in groceries. Unquestionably large quantities of this class of foodstuffs are destroyed in department and other stores and in warehouses handling miscellaneous merchandise which cannot be included under this specific head.

It will be observed that an unduly large proportion of the fires is attributed to unknown causes. Probably the reason for this is to be found in poor housekeeping and neglect to provide watchman service, but it is possible that there may be a goodly number of fires due to hazards of spontaneous combustion not generally recognized.

The special hazards of groceries are few, the storage and handling of matches and the process of coffee roasting being the only two which make any figure as fire causes. Among the common hazards, however, fires due to causes connected with lighting, and also to rubbish and sweepings are abnormally numerous. So far as lighting is concerned, the special degree of hazard would seem to be the result of failure in many groceries to provide adequate lighting equipment. Establishments in which it is the practice to use candles or matches in searching for merchandise are simply tempting the fire fiend. Where it is necessary to use portable lights, these should preferably be electric lamps properly installed and protected by substantial guards. The exceptional number of fires due to rubbish or sweepings points to carelessness in a class of property in which there is need for unusual care in this respect. A similar remark would apply to fires caused by smoking.

Apropos of the high percentage of "large loss" fires, it should be remembered that, quite apart from the combustibility of the stock and its susceptibility to water damage, grocery fires are apt to be very smoky, and therefore difficult to fight. There are, however, several other factors which contribute to the unsatisfactory conditions revealed by the statistics. In the first place, the value of

automatic sprinkler protection would seem to be altogether inadequately realized in the grocery world. Having regard to the fact that large numbers of groceries are located in small cities and towns possessing poorly equipped fire departments, and public water supplies that leave much to be desired in the way of pressure, one would have thought it hardly necessary to argue the advantages of a sprinkler system; but the proportion of unsprinklered groceries would seem to prove the contrary.

Another surprising feature of the record is the comparative infrequency of watchman service. In instance after instance fires had obviously been burning for quite a while before discovered, and losses were correspondingly severe. Besides the smokiness of such fires already mentioned, the large areas of the buildings and the heavy loading of the floors often add to the firemen's difficulties, making it doubly desirable to deal with them in their incipiency. It will be noted that, if watchmen were few, thermostats for alarm service were absolutely non-existent in the properties included in the record.

Construction is the final item of complaint. Attention is particularly drawn to the number of instances in which unprotected floor openings practically doomed large stocks of foodstuff to destruction as soon as fire occurred. Inaccessible and ill-ventilated basements, concealed spaces and unprotected metal members also enter into the account.

In a class of occupancy presenting so few special hazards, it should certainly be practicable to effect a great reduction in losses if reasonable care be exercised. Fortunately, our member, the National Wholesale Grocers' Association, has an active and enthusiastic Fire Prevention Committee which may be trusted to bring to the notice of the grocery fraternity the prevalence of such hazards as those cited.

GROCERIES—FIRE RECORD

Total Number of Fires Reported, 145.

1. Classification of Causes.

Common Causes.

	No. of Fires	Per Cent. of Common Causes	Per Cent. of Known Causes
Heating	2	3.4	2.4
Lighting	9	15.3	10.7
Power	3	5.1	3.5
Lightning	3	5.1	3.5
Smoking	9	15.3	10.7
Chimneys and Flues	4	6.8	4.8
Rubbish or Sweepings	13	21.9	15.5
Oily Materials	4	6.8	4.8
Locomotive Sparks	2	3.4	2.4
Miscellaneous	10	16.9	11.9
Total	59	100.0	

Special Hazard Causes.

	No. of Fires	Per Cent. of Special Hazard Causes	Per Cent. of Known Causes
Matches (storage and handling for sale)	6	40.0	7.1
Coffee Roasting	5	33.3	6.0
Miscellaneous	4	26.7	4.8
Total	15	100.0	
Common Causes	59		70.2
Special Hazards	15		17.9
Incendiary	7		8.3
Exposure	3		3.6
Total known causes	84		100.0
Unknown causes	61		
	145		

Details of Causes.

Under this heading are given brief descriptions of fires caused by unusual conditions or of an educational value in emphasizing the different hazards. Fire caused by ordinary conditions or well understood hazards may not be included.

Common Causes.

Lighting.

S-14301. A gas jet in a vault was left burning overnight. The door of the vault was tightly closed, and when all the oxygen was consumed the light went out. In the morning the door was opened by an employee carrying a candle, and an explosion followed. Sprinklers opened promptly and extinguished the fire. The loss was slight.

H-9576. An employee engaged on the top floor struck a match to procure light in a dark corner. The match head fell on some paper bags, and in trying to extinguish the resulting fire the employee was overcome by smoke and rendered helpless until rescued by the firemen. The fire was confined to the floor of origin, but the contents on that floor were destroyed and there was some water damage on floors below. The loss amounted to $10,000.

H-11230. This fire is believed to have been caused by the use of lighted matches for the examination of stock. It occurred on the fifth floor of the north section, on which there were no lighting facilities. The fire loss was slight, but the water damage considerable. Sub-standard tin-clad fire doors between the north and main sections of the property were closed promptly and were of great value in excluding smoke from the main section. The loss would probably have been noticeably less if the floors had been waterproofed and scuppers provided.

Oily Material.

H-11392. In this case the floor of an office in a wholesale grocery had been oiled with a mixture of "floor oil" and turpentine. The cotton mop with which the mixture was applied was placed by the side of some wooden boxes containing paper. Ignition did not take place until 6 o'clock the next morning, and the fire was then discovered in its incipiency by the watchman of an adjoining property. As no watch service was maintained on the premises affected, it was only a fortunate accident that this was not a very serious fire.

Miscellaneous.

H-5574. The apparent cause of this fire was the "caving in" of an overloaded floor, which caused shelving and contents to strike a lighted gas jet. The loss was total.

H-7641. Mechanics were repairing the elevator machinery and using lighted candles at their work. One of the lighted candles was allowed to fall behind a casing of the elevator shaft and, reaching some greasy woodwork, this set the entire shaft ablaze before aid could be summoned. The contents of the two upper stories were destroyed and the two lower floors sustained water damage. The interior of the upper part of the building and the roof were also badly burned.

Special Hazard Causes.

Storage of Matches.

H-7198. About a carload of matches was stored in the center of this brick building, and the fire started among them. There were no city fire alarm boxes, and consequently the firemen could not be summoned immediately. The dense smoke prevented the firemen from locating the seat of the fire until flames burst through the roof. The loss was practically total.

H-8966. $35,000 went up in smoke at this grocery as a result of the careless handling of packages of matches. The spread of fire was facilitated by uncleanly conditions.

Coffee Roasting.

S-13618. Fire occurred in a galvanized iron exhaust pipe between the air cooler at the coffee roaster and a brick chimney. The apparatus had been in service for several years, and probably a considerable quantity of dust and chaff had accumulated in the pipe. This accumulation became ignited either spontaneously or by a spark from burnt coffee, and the first warning was given when the pipe became red hot. One sprinkler operated about two feet distant, but the water was shut off immediately on the arrival of the firemen, who extinguished the fire in the pipe with chemical extinguishers. The bulk of the resulting small loss was due to

water damage from the sprinkler. **Had the exhaust system been cleaned out at regular intervals this fire would probably have been avoided.**

H-12178. On the second floor of a wholesale grocery house was a gas-heated coffee roaster, the stack from which extended through the roof. Fire started from the ignition of cartons of cereal in contact with the stack on the third floor. The third and fourth floors and about half the roof were damaged by fire and there was heavy water damage. In all, the loss amounted to nearly $54,000. Following the fire, the coffee roasting room was remodeled, a hollow tile stack supported on iron girders being erected with air space around the flue. The floor and ceiling were also protected.

MISCELLANEOUS STATISTICS.

2. Analysis of Loss.

	Common Causes		Special Causes		Unknown Incendiary Exposure		Total	
	No. of Fires	Per Cent.	No. of Fires	Per Cent.	No. of Fires	Per Cent.	No. of Fires	Per Cent.
No Claim	8	15	1	8	5	8	14	11
Small Loss	33	64	7	54	22	33	62	47
Large Loss	11	21	5	38	39	59	55	42
Total with data given...	52	100	13	100	66	100	131	100
No data	7		2		5		14	
Total	59		15		71		145	

3. Day or Night Fires. **(Day Fires 6 a. m. to 6 p. m.)**

	Common Causes		Special Causes		Unknown Incendiary Exposure		Total	
	No. of Fires	Per Cent.	No. of Fires	Per Cent.	No. of Fires	Per Cent.	No. of Fires	Per Cent.
Day	27	50	10	71	16	25	53	40
Night	27	50	4	29	48	75	79	60
Total with data given...	54	100	14	100	64	100	132	100
No data	5		1		7		13	
Total	59		15		71		145	

4. How Discovered.

	Common Causes		Special Causes		Unknown Incendiary Exposure		Total	
	No. of Fires	Per Cent.	No. of Fires	Per Cent.	No. of Fires	Per Cent.	No. of Fires	Per Cent.
Employee	15	34	8	61	11	16	34	27
Watchman	3	7	..	..	3	5	6	5
Sprinkler Alarm	11	25	1	8	7	10	19	15
Outsider	14	32	3	23	45	66	62	50
Supervisory	1	2	1	8	2	3	4	3
Total with data given...	44	100	13	100	68	100	125	100
No data	15		2		3		20	
Total	59		15		71		145	

SPRINKLER FIRE RECORD.*

5. Effect of Sprinklers.

	No. of Fires	Per Cent. of Whole
Extinguished or Practically Extinguished Fire	37	77.1
Held Fire in Check	7	14.6
Unsatisfactory	4	8.3
Total	48†	100.0
No Claim	9	20.5
Small Loss	28	63.6
Large Loss	7	15.9
	44	100.0
No data	4	
Total	48	

*There were 7 fires in which no sprinklers were opened.
†2 of these fires are omitted from Tables 6 and 7 owing to insufficiency of data.

6. Number of Sprinklers Opened.

No. of Sprinklers Operating	Extinguished Fire		Held Fire in Check		Unsatisfactory		Total	
	No. of Fires	Per Cent.	No. of Fires	Per Cent.	No. of Fires	Per Cent.	No. of Fires	Per Cent.
1	15	40.6	4	57.1	—	—	19	41.3
2	11	29.7	—	—	—	—	11	23.9
3	3	8.1	1	14.3	—	—	4	8.7
4	2	5.4	1	14.3	—	—	3	6.5
5	1	2.7	—	—	—	—	1	2.2
6 to 9 inc.	1	2.7	—	—	—	—	1	2.2
10 to 24 inc.	4	10.8	—	—	—	—	4	8.7
25 to 49 inc.	—	—	1	14.3	—	—	1	2.2
50 and over	—	—	—	—	2	100.0	2	4.3
	37	100.0	7	100.0	2	100.0	46	100.0

No. of Sprinklers Operating	No. of Fires	Per Cent. of Whole
1	19	41.3
2 or less	30	65.2
3 or less	34	73.9
4 or less	37	80.4
5 or less	38	82.6
Less than 10	39	84.8
Less than 25	43	93.5
Less than 50	44	95.7
50 and over	2	4.3

Unsatisfactory or Large Loss Sprinkler Fires.

S-8078. The loss in this case was practically total. The fire had made considerable headway before it was discovered, and by the time the fire department arrived it was quite beyond control. In addition to a water motor gong at the building, there was a home-made electrical contrivance for operating an electric bell in the fire station. The local gong began to ring subsequent to the arrival of the department at the fire, and the bell also operated after they had left the station house. The sprinkler equipment, which was on the dry system, failed to operate, and subsequent investigation showed that the air valve had started to operate and then stopped. The indications tended to show that the yard post indicator valve controlling the system was nearly shut, the increased fire pressure allowing enough water to pass to operate the alarms tardily.

S-13940. This fire occurred under peculiar circumstances. The property was being remodeled for the occupancy of the grocery company which had recently purchased it. In connection with the remodeling, it was necessary at different times to close valves attached to the sprinkler equipment, and in the installation of the coffee roasting area it was found necessary to take down sprinkler piping. The lines were not plugged, but water was shut off the system. The result was that nothing was left standing except a small portion of the walls, and these had to be torn down. It is of interest to note that wired glass in metal frames saved several neighboring properties which would otherwise have suffered serious damage.

S-17480. A remarkable illustration of the folly of leaving a sprinkler system out of commission even for a short time. On the day preceding this fire there had been a small blaze due to the ignition of a wooden barrel by hot peanuts put into it. This had been extinguished by sprinklers with slight loss, and water was then temporarily shut off the system. In the early hours of the next morning a fresh fire occurred, probably as the result of a spark left from the previous outbreak, and, there being no water available to the sprinklers, the loss was nearly total.

Points of Interest from Fire Reports.

Automatic Sprinklers.

S-13777. The most extraordinary feature of this fire is that it did not destroy the whole building. It started in a box containing floor sweepings, located within six feet of several barrels of oil and other combustibles. A sub-standard tin-clad door immediately adjoining the fire opened into an elevator shaft. The sprinklers with which the building was equipped were of an old-fashioned type,

known to be unreliable, and the only source of water supply was a small pressure tank. The thermostats, which constituted the alarm service, were of an obsolete type, and there is no evidence of their having operated. Nevertheless the fire was only discovered when the store was opened on the following morning, and a badly burned door, charred joists and a small hole in the flooring overhead were disclosed. There was some water damage to stock.

S-15848. This fire is supposed to have originated with a match or cigarette stub thrown by a passerby through a crack in the stone sidewalk or through a missing bullseye into a small room under the sidewalk, partitioned off from the main basement. The sprinklers under the sidewalk had been disconnected subsequent to a "freeze up" about three weeks previously, and the fire acquired sufficient headway to open 20 sprinklers in the main basement with the heat. These sprinklers held the fire in check pending the arrival of the fire department. The loss was very moderate, but a considerable quantity of groceries was drenched in the basement. Practically all of the loss might have been avoided if the sprinklers under the sidewalk had been reconnected as they should have been.

Fire Walls and Doors.

H-2758. The total destruction of an entire block was probably prevented by the satisfactory fire stop made by the fire wall and double fire doors which protected the openings between the old and new sections of this grocery. The old section in which the fire occurred was of light joist construction, and owing to this fact and the combustible nature of its contents, it speedily became a mass of flames, scattering burning embers for a considerable distance. During the progress of the fire falling timbers pressed so heavily against the fire doors as to spring them at the bottom, thus making an opening to the new building. At this point the employees did excellent service with hand chemical extinguishers and chemically wet sawdust, thus preventing entrance of the flames.

H-5942. When discovered, fire had been burning for some time in a small storeroom on the second floor. Although the main elevator shaft passed through the storeroom, the fire doors at the openings prevented the fire from ascending to the floors above, and the loss was small.

H-11156. A loss of $200,000 resulted from this fire, which spread from one section of the property to another by means of an unprotected carrier opening, 2 feet square, through a brick firewall. **The folly of leaving such small openings unprotected cannot be too strongly emphasized.**

Vertical Openings.

H-2491. Occurring in a small town having only a small and poorly equipped fire department, this fire spread so rapidly by means of unenclosed elevator shafts that all hope of saving the property was soon abandoned. Unprotected window openings, through which

the flames entered the main section from the frame loading shed where the fire originated, also contributed to the disaster, and the bursting of hose several times during the fire hindered the firemen. Before the fire was extinguished it had caused the death of two firemen and serious injury to the chief from falling walls, and had seriously damaged two adjoining structures. The total loss was nearly $99,000.

H-6714. This fire, which is believed to have been caused by a gas plate used for boiling water, and located, six inches distant from a frame partition, on a wooden bench with metal underneath, but no air space, would probably have been confined to one floor if the double matched board traps on the stairway had not been held open. There was heavy fire damage on two floors, and water damage on all.

H-7500. Oil clothing had been hung up in the basement, and fire is thought to have originated in this clothing. The blaze was for some time confined to the basement owing to the fact that the stair and elevator shafts were here enclosed. As soon, however, as the first floor was burned through, the flames rapidly communicated by the open stairway to all floors and the roof.

H-7598. Unprotected floor openings were mainly responsible for this loss of $38,000.

H-8128. A total loss of $350,000 resulted when this seven-story and basement grocery burned. The fire started on the first floor and spread with astonishing rapidity through unprotected vertical openings. The steel and iron supporting members (which were also unprotected) buckled and twisted under the heat, the upper floors collapsed, and the east and south walls gave way and fell outward.

H-9627. Trap doors constructed of one-inch matched boards, hinged and held open by fusible links, operated satisfactorily and confined fire to upper floors. The water loss was heavier than it need have been, owing to the absence of tarpaulins or other means of protection against water damage.

Basements.

H-5341. Poor ventilation of the basement of this grocery was largely responsible for an explosion of accumulated vapors from gasoline and kerosene stored there when a fire originated in the basement from another cause. After this explosion the fire made great headway and did $50,000 damage before it was extinguished. **Even a well-ventilated basement, however, is a most unsuitable place for the storage of gasoline, which should be kept in outside tanks of approved construction.**

H-12611. There were no outside openings to this basement, and the smoke, being very dense, it was impossible for the firemen to reach the seat of the fire from the stairway opening. The fire was not extinguished until after the collapse of the first floor.

Watch Service.

H-5376. A loss of $66,500 was caused by this fire, which, owing to the absence of alarm service, had gained great headway before its discovery.

H-7131. This $150,000 fire was not discovered until it had been burning for several hours. No watchman service was maintained.

S-15727. This fire occurred on a Saturday afternoon after the grocery had closed, but before the watchman, who was on duty at night only, had arrived. Three sprinklers extinguished the fire, but the water loss was heavy, as there was no one on the premises to shut off the water, and no automatic alarm service was installed.

Miscellaneous.

H-11130. Fire started at the rear of the building, and had gained considerable headway before discovery. A passerby broke in the front door before the arrival of the fire department, and the fire at once spread to the front of the building. A corrugated metal roof without openings through which flames and smoke could escape caused the fire to spread laterally,—a process which was greatly facilitated by wooden partitions and concealed spaces in the ceilings.

General Fire Record.

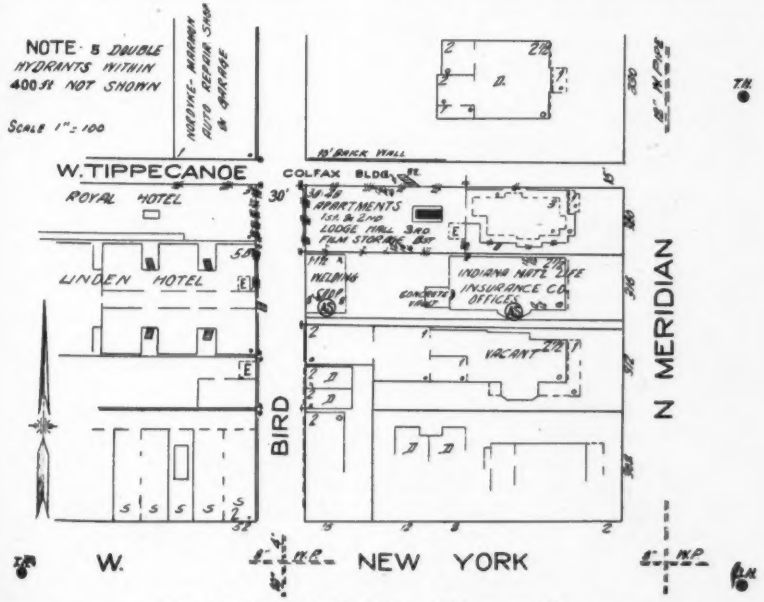
Film and Celluloid Scrap Fire in the Colfax Building, Indianapolis.

April 19, 1917.

Special Report by Indiana Inspection Bureau, E. M. Sellers, Publisher, (Member N. F. P. A.)

Fire occurred in the property known as the Colfax Building, situated at No. 320 North Meridian Street.

Construction and Occupancy: Building as originally constructed was used for dwelling purposes, and was three stories with basement in height, and with a ground floor area of approximately 35 by 65 feet. Later, an addition was erected in the rear, this addition being three stories and basement in height, and 40 by 100 feet in area. Walls were 16-12-inch brick; floors were of ordinary wood-joisted



Plan showing Colfax Building and its surroundings.

construction; roof was metal and composition on wood sheathing. There were two open stairways, one in the front of the building, extending from the first to the third floors, the other in the south of the rear building extending from basement to third floor; open elevator shaft from basement to third floor in center of building. The entire front section was occupied as dwellings and apartments. The first and second floors of the rear section were used for the same purpose, the third floor being occupied as a lodge hall which was used occasionally by the public. The basement of the front section was used for storage purposes and boiler room, but boiler was not in use. The basement of the rear portion was occupied for the storage of old furniture, and by the Oxon Chemical Company for the storage and handling of motion picture films and scrap celluloid. The apartments on the different floors were divided by lath and plaster partitions. Lighting was by electricity, wiring being in metal conduit, and heat was by steam from outside source. The different apartments used gas for cooking, and some swinging gas brackets were found.

Private Fire Protection: None. Janitor slept in building, but did not act as night watchman.

Public Fire Protection: Adequate number of double and triple hydrants nearby on large size mains.

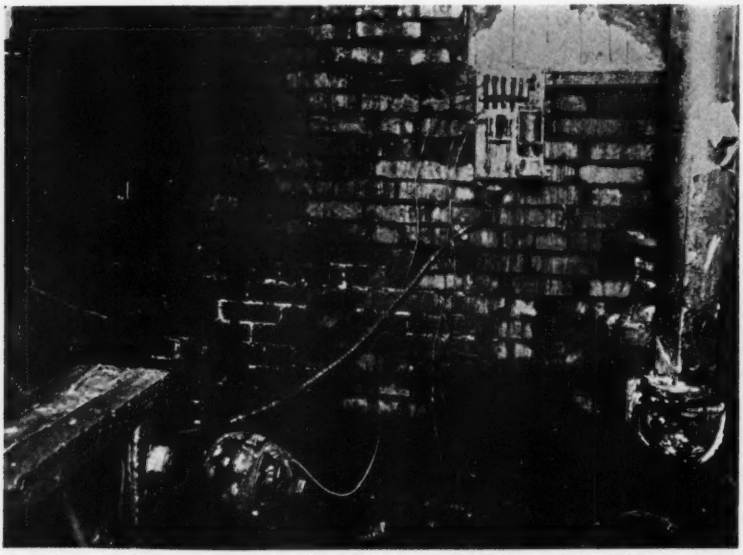
Discovery and Alarm of Fire: Fire was first discovered by the watchman in a fire tower located on the Merchants Bank Building. He noticed a sudden burst of flame, and immediately telegraphed No. 46 to all fire companies, this being the number of the fire box located within two blocks of the scene of the fire. The first alarm was turned in at 6:42 p. m., and the second alarm followed six minutes later. Fire companies responded promptly and lost no time in locating the burning building.

Details of Fire: The fire unquestionably originated in the rear of the basement which was used by the Oxon Chemical Company. This company was a buyer of scrap celluloid and old films which were sold to different concerns after the gelatine coating of films had been removed for the purpose of reclaiming the silver in same. The removal of coating was accomplished by soaking the films in hot water, and in some instances after this was done coating was scraped from films by means of a motor-driven machine. At the instigation of the Commissioner of Buildings, a fire-resistive vault having 8-inch tile walls and 6-inch reinforced concrete roof, with opening protected by a single non-standard fire door, had been provided. Instructions had been given to store all films in vault, with the exception of those being treated, but at the time of the fire the vault door, which was provided with an automatic closing device, was held open by a wedge driven between track and top of door, and there was a large number of wood barrels and boxes containing untreated films and celluloid scrap outside the vault. Films were thrown promiscuously into the wood receptacles, and while several

Room occupied by Oxon Chemical Co. Barrels and boxes contained scrap film. Iron bound barrels contained film under water. Film vault is seen in upper left-hand corner.

metal containers were found, it was apparent that films had not been kept therein. The first indication of fire was an explosion, closely followed by flames bursting from windows. Building walls and floors were uninjured by the force of the explosion, although the windows in the rear wall of the Royal Hotel Building and the north tier of windows of the Linden Hotel Building were shattered, and wood window frames badly charred. A 30-foot street intervenes between these buildings and the Colfax Building. Flames from basement windows were carried upward, entering windows of third floor of rear section, afterwards working downward through open elevator shaft and stairway to second and first floors. Fire was communicated from basement to first floor through open stairway. It is also evident that fire occurred in the first floor of the section directly over the film occupancy, immediately following the explosion, through the ignition of gases thrown off by films. An interesting fact is that while the rear portion of the building on the ground floor was badly damaged, as well as the top floor and roof, the second floor shows comparatively little damage.

When the first companies arrived, flames were issuing from all the windows in the rear section of the building. Direct hydrant streams were immediately placed, and one engine stream was used. Altogether ten streams were employed, and in addition 108 gallons of chemical were used. Lines were taken into the front of the building, and were also played on the fire from the roofs of ad-



Switch controlling motor was closed. Motor located within two feet of drum on which films were wound. Note insulation torn from steam pipe by force of explosion.

joining buildings. The water pressure was excellent, and it was only necessary to resort to the use of one engine stream. The fire was under control in three hours and was confined to the building in which it originated.

The exact cause of the fire has not been determined. While an official of the Oxon Chemical Company testified under oath that neither he nor any of his employees had been on the premises for several hours preceding the fire, an examination of the room occupied by his company the morning following the fire disclosed the fact that the switch controlling the direct current motor operating the film scraping machine was closed. The motor was within two feet of the machine, and had it been in operation the film on the machine could have been ignited by a spark from the commutator. The motor had been installed in violation of a city ordinance which provides for the inspection of all electrical apparatus, and no application had ever been filed for its inspection. Another theory is that films thrown into wood containers may have become sufficiently heated by nearby steam pipes to cause decomposition and to ignite. It is also possible that old automobile curtains, which were kept in barrels, may have contained sufficient foreign matter to ignite spontaneously.

Loss of Life: Six persons residing on the first floor of the rear section lost their lives. The bodies of all were severely burned, but the condition of one indicated that life may have been extinct

before it was reached by fire. In all probability death was caused by the inhalation of carbon monoxide gas given off by the burning films. Several persons were severely injured by falling glass and bricks. The president of the Chemical Company was arrested on a charge of involuntary manslaughter, but has been released under a high bond. The case is being investigated by the Marion County Grand Jury.

Observations: The fire serves to strongly emphasize the following:

(1) The extreme hazard from nitro-cellulose films when improperly handled and stored.

(2) The need of the adoption and proper enforcement by municipalities of drastic ordinances governing the storage and handling of nitro-cellulose films.

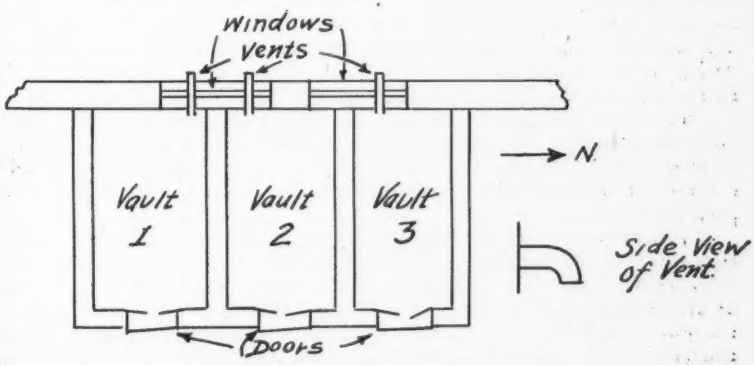
(3) The necessity of frequent and thorough inspection of all film exchanges, etc., by members of fire departments.

Motion Picture Film Fire in the Consumers' Building, Chicago.

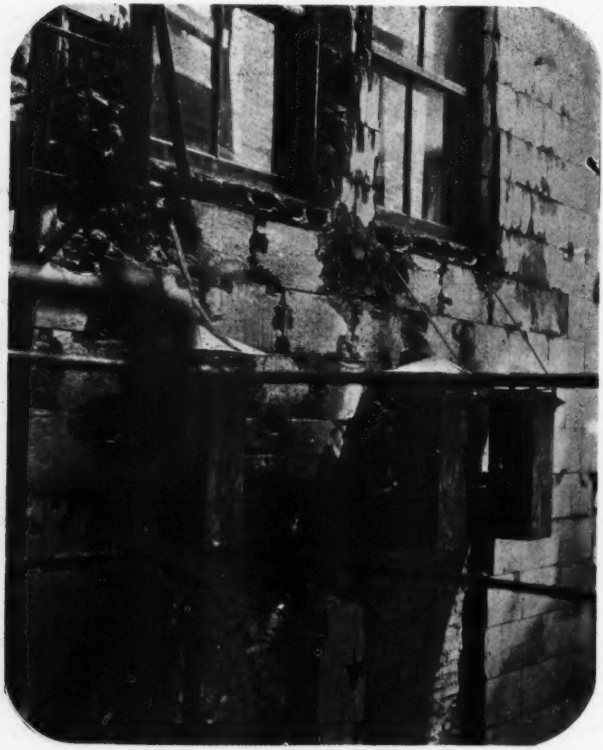
July 1, 1917

Special Report by Chicago Board of Underwriters of Chicago. W. D. Matthews, Chief Surveyor, (Member N. F. P. A.)

Fire started from unknown cause in a film storage vault of the Pathé Film Co., occupying two-thirds of the fourth floor of the Consumers' Building, a twenty-one story and basement building of fire-



Sketch of film vaults in Consumers' Building.



Shows arrangement of ventilators as installed after the Consumers' Building fire without consulting inspection department having jurisdiction.

resistive construction. Total loss to film stock, advertising paper and announcement lantern slides, and $58,872 loss to the building, which, owing to superior construction, was confined almost entirely to the outside window casings and ornamental glazed tiling.

The outbreak was discovered by unknown person on the street, who, observing dense volumes of smoke and flames coming from the west end of building, sent in an alarm at 3:11 a. m. from Box No. 46, located at Adams and State Streets, one block from the above premises.

There were four employees on the premises at the time, who claimed that they had just finished the usual day's shipments and were closing up. One of them, on returning from the wash room at about 3:20 a. m., noticed smoke coming through the cracks about the door from the center of three film storage vaults located along the west wall. He telephoned an alarm, but found the fire department then on its way. The slight explosion which, according to the

Shows how the Consumers' Building fire affected ornamental glazed tiling.

chief of the engine company, followed the smoke, was undoubtedly due to the confined heat and gases from the rapid burning of the film and paper stock. This blew out the windows on the street side of the building, allowing the fire to communicate through the window openings to the upper floors, causing a total loss to tailoring stock and fixtures on the fifth floor and a partial loss to stock and office fixtures of firms occupying the west end of the sixth, seventh, and eighth floors.

The fire was of short duration, but intense, so much so as to melt the wired glass windows of the floor above, badly crack the wired glass windows on the floor below, and spread across a 12-foot alley to the Baltimore Building, an eight-story and basement brick, at 18-22 Quincy Street, entirely destroying the stock and fixtures of tailoring and publishing firms occupying the east end of the fifth, sixth, seventh and eighth floors and causing an approximate damage of $15,000 to the building.

Investigation showed lax methods in the handling of films by the Pathé Company, who were not even observing the general rules pertaining to scrap film and enclosed reels. Scrap film was found on the floor of the repair room and in paper rubbish of paper baling press. Several open reels were on a table in the shipping room and two reels in the repair room; and approximately one-third of those stored in vaults No. 1 and No. 3 (see sketch) were not in

individual containers, but were stacked on metal racks in open reels. The films in vault No. 2 were in a pile on the floor at the east end of the vault.

The vaults, which had 12-inch tile walls and ceiling and concrete floor, were each 4 feet 6 inches by 12 feet in area, built against west wall of building and communicating with each other through common wired glass windows to alley, and wooden stringers embedded in wall at window sill. Vaults vented through 8-inch by 12-inch light constructed metal vents arranged in one of the upper window panels to the alley. Entrance to vaults was through separate standard double vault doors securely built into the east end. Lights, electric wiring and metal racks were of standard construction and installation. Had the vaults been separated with no communication, and had the doors to vaults No. 1 and No. 3 been closed, the films in these vaults would not have been damaged.

The manager believes the fire of incendiary origin due to labor troubles. He claims that the explosion in the center vault opened the film containers, started the fire and blew the door from the center vault, allowing fire to escape.

Investigation, however, showed that the fire escaped into the premises by way of vaults No. 1 and No. 3, the doors of which were partially open, and that the door on vault No. 2 was closed, locked and in place when the fire department arrived. In order to get at the burning film on the inside of vault No. 2, the firemen picked out the door with their axes. The explosion which occurred after the fire had started was in the packing and shipping room, and was undoubtedly the usual explosion which accompanies rapid combustion. The explosion did no damage whatever to the interior of the premises.

It was fortunate that the fire did not occur during the regular business hours, as the dense volumes of smoke and fumes which filled the building, getting into the various floors through the open grill of the elevators, made it impossible to use the elevators or stair shafts.

Recommendations.

Strict observance of present rules regarding the storage and handling of films.

Rigid enforcement of present rules regarding the construction and ventilation of film storage vaults.

Film vaults to be entirely separated from balance of premises and vaults and repair rooms to be protected with automatic sprinklers.

No openings within 15 feet of mouth of ventilator from film storage vaults.

Heavy exposure charge for unprotected openings and charge for protected openings within 20 feet facing a film exchange.

Waterproofing of floors in fireproof buildings.

Fires in which there was Loss of Life.

These fires are intended to point out conditions under which loss of life occurs, that they may be known and guarded against.

H-11730. Saw Mill. Lightning struck a 150-foot metal smokestack set on 35-foot brick foundation. The stack had no metallic connection with the boilers nor with the earth except through stranded steel guy wires which were carried well into the ground and anchored to cast iron grate bars. The lightning stroke occurred with a severe detonation and the discharge appeared to enter the earth through the upper guy wires, a flashing of bluish flames from all four of these being observed throughout their entire length. Two laborers were inside the stack removing scaffolding, and one of them, who was near the top, fell and was killed. No burns were found on the body and he probably was thrown from his position by shock or fright.

H-11832. Munitions Factory. Three men were killed by an explosion in an isolated press mill. After the explosion nothing was left to form the basis of an investigation into the cause.

H-11864. Conflagration. One death was reported as resulting from a conflagration which destroyed four town blocks under circumstances of considerable instructive interest. The fire was due to the defective wiring and arrangement of an electrical generator driven by water power and left running overnight to supply power to a paper mill nearby. **It was customary to run this generator without attendance except for an occasional visit by a paper mill employee.** The fire had attained considerable headway before discovery. The town fire whistle was then sounded, but the water pressure available to the volunteer fire department was altogether inadequate. The direction of the wind drove the flames directly against the unprotected windows of a light and power plant which also contained the main fire pump of the town water supply. When this pump was put out of action, which occurred about 20 minutes after the first alarm, the pressure on the hose streams became negligible. Shortly after the fire was discovered, water was turned into the antiquated sprinkler system with which the building in which the fire started was partially equipped. There were three or four other buildings equipped with sub-standard sprinklers in the conflagation area, and it is claimed that the water taken by these sprinklers during the early minutes of the fire was a factor in reducing the pressure on the hose streams. In view of the generally unsatisfactory character of the water supply, however, it seems hardly necessary to look to the sprinkler systems for an explanation of its failure.

Construction was generally poor, the outstanding exception being a concrete fire-resistive vault containing a valuable stock of silk which was undamaged.

After the fire pump failed bucket brigades were the only protection available until the arrival of assistance from neighboring cities. The fire was extinguished by hose streams taken from a neighboring canal about 7 hours after discovery.

H-11891. Cotton Waste Mill. The roof of this mill gave way and precipitated three firemen who were at work upon it into the burning wreckage beneath. One was killed and the others were badly hurt.

H-12031. Chemical Works. An explosion occurred at a mixing kettle for mixing benzol and sulphuric acid. Either the kettle became overheated as a result of chemical action, or the vapors became in some way ignited. Four men were badly burned, one of them subsequently dying in hospital.

H-12045. Apartment House. Fire started at about 8 p. m. in waste paper and rubbish which had been allowed to accumulate in the heater room in the basement. This room was not of fire-resistive construction and the door to it is said to have been open and off one of its hinges so that it could not be closed. The flames spread rapidly through the basement and up the unenclosed stairs, filling the building with smoke. The caretaker, who discovered the blaze shortly after it started, wasted valuable time, first by trying to extinguish the fire himself instead of sending in an alarm, and then by telephoning to the fire department instead of pulling a nearby alarm box.

The department responded promptly and set ladders against the building. The stairs were soon aflame and could not be used as a means of exit. Some of the occupants were brought down on fire ladders and others jumped to life nets, many being injured. One woman was burned to death, one was suffocated and a third died as a result of injuries sustained.

The coroner's jury found that the caretaker was evidently under the influence of liquor at the time of the fire and showed a decided lack of judgment; but it is interesting to note that although the fire was the result of criminal negligence by reason of the condition in which the basement was maintained, and notwithstanding the fact that the non-fire-resistive construction of the heater room and the accumulation of rubbish therein were both in violation of city ordinances, no one was indicted by the jury.

H-12067. Graphite Works. An attendant first had his attention drawn to this fire by the glare in the room. On approaching the graphite furnace where the trouble occurred, he found the foreman lying dead on the floor before it. He had evidently been caught unaware when the white-hot graphite was exposed, and was overcome by the intense heat. Owing to the high temperature it was impossible to get near the body or the fire, and water had no effect. The hose stream was therefore shut off and ash allowed to form on the graphite, thus finally deadening the fire. The bars of graphite in the furnace were piled in two banks side by side and set on a

thick layer of a mixture of sawdust, ground coke and sand. The spaces between the bars were filled with ground coke, while more of the mixture mentioned above was placed at the sides and over the graphite. The mixture is a non-conductor of electricity at the voltage used and was intended to hold the heat in the furnace. Heavy concrete blocks were placed in two tiers at each side of the furnace to form the furnace walls and to hold the mixture at the sides of the graphite bars. About 20,000 amperes at 50 volts was being passed through the furnace to provide the necessary heat and the temperature of the bars was about 7,500° F.

Although the concrete blocks have many 1-inch holes through them to permit of the escape of gas, it is thought that an accumulation of gas must have occurred at the back of one or more of the blocks, resulting in an explosion which exposed the white-hot graphite. The air coming in contact with the graphite probably caused more concrete blocks to be thrown down and a portion of one bank of graphite bars to burn fiercely on one side. Five concrete blocks in all were thrown to the floor. **The utmost care should be exercised in such cases to see that ventilating openings in the concrete blocks are kept free from obstruction.**

H-12093. Chemical Works. During the process of saponifying dinitro-chlorbenzol, the sodium salt of dinitrophenolate, to the amount of probably 2,000 lbs., was sublimed on the top of the inside of a closed steel autoclave. From some unexplained cause these salts exploded, killing two men and lifting two thirds of the roof of the building. Subsequently to this explosion the process was changed and conducted in open vertical tanks with no tight fitting covers.

H-12129. Cooperage. In this case three boilers exploded, killing 8 persons and injuring 15 others.

H-12131. Munitions Factory. The building in which this fire occurred was a small one-story metal-clad structure where smokeless powder was brought from the drying houses and shaken through a coarse screen to separate any grains that might be stuck together. The cause of the fire is unknown, as the quick flash that shot up through the roof killed the 6 men who were at work in the building. All the powder was destroyed, as well as the greater portion of the building.

H-12191. Chemical Works. A tank of 450 gallons capacity was used for collecting acetone as it came from the stills. In the top of the tank was a vent hole through which was run a gauge stick. It was the duty of the operator of the still house to have the tank emptied as soon as it became half full, but it is supposed that on this occasion the tank was forgotten and allowed to overflow. The acetone ran out onto the floor, and the fumes therefrom being ignited from one of the fires under the stills or kettles, a flash fire resulted which, though doing little structural damage burned a fore-

man so badly that he died within a few hours. After this accident, the measuring stick was removed and the pipe leading from the vent was extended outside the building.

H-12207. Harness Warehouse. This fire is attributed to the dropping of matches in a pile of sweat pads by two electricians repairing the lights. A large quantity of pads was piled near where the electricians were working, and the fire spread so rapidly that the employees on the upper floors were cut off from the stairways. Both electricians were badly burned and in jumping from the upper windows one of the employees was killed and several seriously injured. **Automatic sprinklers would almost certainly have prevented this disaster.**

H-12280. Cement Mill. Coal was pulverized at this plant to furnish fuel for the clinker kilns. Spontaneous combustion as a result of chemical action within a pile of the powdered coal is believed to have been responsible for a burst of flame which caused the immediate death of a workman nearby.

H-12288. Home for Old People and Orphans. This was a two and three-story stone building, with wooden floors and metal and shingled roofing, **in three sections, which were not divided by fire walls.** The building was heated by two steam boilers located in the basement near the center of the building. One of the boilers was very poorly supported and it seems clear that it fell and broke the pipes which fed fuel oil to the boilers from outside tanks. The fire was first discovered by inmates who were awakened by the noise and by smoke in the rooms. A boy, aged 16, who was supposed to be in charge of the boilers, had fallen asleep and in his excitement on being awakened by the fire, he accidentally cut out all the lights in the building instead of shutting off the oil pumps. The oil spread over the floor of the basement and the institution was doomed. The firemen responded promptly to a telephonic call for aid, and, although they were prevented by the extreme heat from gaining entrance to the basement or first floor, they did heroic work in rescuing the inmates, of whom there were more than a hundred. Five lives were lost despite their efforts,—two old men, two old women and one young girl who returned to the building to get her clothing.

The circumstances of this fire emphasize the need for all institutions of this kind to have approved watchman service, adequate interior standpipe and hose equipment, separate fire-resistive buildings to contain their heating plants, and standard fire walls with openings protected by standard automatic fire doors.

H-12317. Varnish Works. A spark ignited dust in the blower system for removing dust from gum sorting. The burning dust was blown back through a tunnel to a gum stack, where it caused an explosion (probably of naphtha fumes) which caused the death of an employee.

H-12334. Lumber Yard. The cause of this fire was very unusual. A man and woman were forced overboard and drowned, when their gasoline launch took fire, probably as a result of smoking. The burning launch then set fire to Norway pine lumber piled endways to the river in a single long pile of considerable height. A rule of the yard that a clear space of 50 feet must be left between the yard and any dock storage much facilitated the task of the firefighters, who were also fortunate in having no trouble with the wind. Having regard to the limited supply of water available from hydrants, the result would probably have been different if there had been any considerable wind blowing from the riverside. As it happened the loss was confined to a very moderate amount.

H-12390. Tenement House. Forty persons are believed to have been killed by an explosion which completely wrecked this three-story and basement building. The explosion was caused by a neglected gas leak.

H-12401. Mercantile. Fire occurred in a new addition and communicated with the original building through unprotected openings which had been cut in the existing walls. **It was the intention at some future time to protect these openings with fire doors.** The flames rapidly spread to all portions of the second and third floors. One man was killed while an attempt was being made to clean up the premises, which were in an unsafe condition. If fire doors had been installed, not only would the loss have been much less, but a life might have been saved.

H-12430. Munitions Factory. Owing to the complete destruction of the building and contents, it was impossible to determine the cause of the explosion which, entirely without warning, blew up in one large flash this detached smokeless powder dry house. Of 14 men working in the building or its vicinity, 12 were killed and the remaining two were severely injured. The survivors were unable to throw any light on the cause of the explosion.

H-12477. Munitions Factory. One man was killed and 9 injured by this explosion in a smokeless powder dry house. 50,000 lbs. of powder were drying out in the bins at the time of the fire, but no employees were in the building, as the crew happened to be at work on a coal pile at the north of the house. Just previous to the flash, one of the employees had experienced some trouble with the hoist at the front side of the building and the foreman of the crew went over to inspect the hoist. As he could find nothing wrong he turned around to return to the coal pile and had proceeded about 50 feet when the entire structure and contents blew up. The foreman died of his burns, and all the men on the coal pile were burned more or less seriously.

H-12502. Stable. The overturning of a kerosene stove during a scuffle was the cause of this fire. Two men lost their lives, while trying to save the horses.

H-12524. Rooming House. Three men were burned to death and one seriously injured in this fire. Incendiary origin is suspected.

H-12536. Rooming House. This fire started at 3 a. m. from an unknown cause in the large dining room which formed the front part of the first flat. This room was chiefly used as the family house, and it had four anterooms partitioned off. The two upper flats were used as bedrooms. All those in the upper flats found their means of exit cut off. Three lost their lives and three were badly injured in escaping from the upper windows.

H-12544. Residence. Rubbish from a photographic gallery was allowed to accumulate on the floor at the bottom of the main stairway of this three-story brick building, which was occupied partly by the gallery and partly for residential purposes. When the rubbish ignited, fire and smoke quickly filled the upper part of the residence portion, and a family of six were found suffocated after the spread of fire had been checked. The occupants were all poor people.

H-12571. Hotel. At 3.30 p. m. an employee noticed smoke coming from the beer room in the basement. An alarm was turned in by telephone, and promptly answered, but the firemen not being provided with smoke helmets, were unable to reach the fire owing to the dense black smoke which filled the building. There were no fire escapes in the hotel and one death by suffocation occurred. A number of rescues were effected by firemen with ladders.

H-12585. Mercantile. Three firemen were killed and five others badly injured by falling walls when this three-story and basement mercantile building burned.

H-12685. Picture Frame Factory. The watchman's body was found in the ruins of this factory after its destruction by fire from an unknown cause.